LIBRARY OF CONGRESS
RECEIVED
JUN 8 1899
PERIODICAL DEPT.

Standard Size, 9 x 12. JUNE 1, 1899. Price Six Cents.

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS.
Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 22.

Contents and Index to Advertisers, Page 8.

If you are NOT manufacturing machines in quantities, you cannot use one of our lathes to advantage. If you make duplicate parts of cast iron, steel or brass which must be bored, turned and faced, you can use one

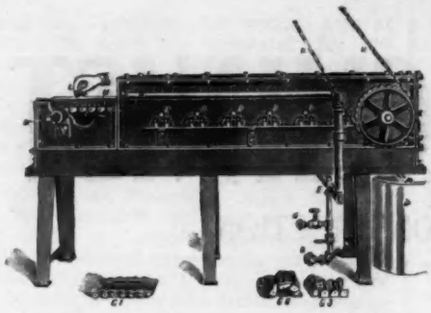
GISHOLT
LATHE

to do the work of several engine lathes. Hundreds of our lathes are in use, each one producing several times as much work as can be done on an ordinary lathe. . . . .

SEND FOR FULL PARTICULARS.

GISHOLT MACHINE COMPANY,
MADISON, WISCONSIN, U. S. A.

Eastern Branch—126 Liberty St., New York, Walter H. Foster, Sales Manager; U. Baird Machinery Co., Pittsburgh, Pa.; C. W. Burton, Griffiths & Co., 1, 2, 3 and 4 Ludgate Square, London, E. C., Eng.and; Fenwick Frères, 21 Rue Martel, Paris, France; Schuchardt & Schütte, Berlin, Cologne, Vienna, Stockholm.



"Willful Waste Makes Woeful Want."

It's willful waste to do tempering, annealing or case hardening with the old, back-number coal or coke furnaces—waste of time and fuel, and often of costly materials.

It may not make woeful want in your particular case, but it will make a difference that will be felt in the biggest and best of shops, as compared with the present-day Gas Furnace methods of doing such work—a difference in profits and in quality of output.

Here we show Heating Machine No. 4. This machine is designed for heating large quantities of small steel work of uniform size and weight, evenly and uniformly, to any required degree for hardening or for annealing, automatically. The output of this machine is over 1,000 gross of small, thin, steel articles in a single hour. Compare this with the capacity of any coal or coke apparatus you ever saw or heard of, and you'll be convinced that the clean, easy, economical, rapid, and accurate Gas Furnace way is the right way. Send for the other interesting particulars.

Write for Catalog of Fuel Gas Plants.

American Gas Furnace Co.,

23 John Street, New York.

Chas. Churchill & Co., London. H. Glaenzer & Perreaud, Paris. Schuchardt & Schütte, Berlin, Cologne, Vienna, Brussels, Stockholm, New York.

There's A Plenty

of "pretty fair" planers—the kind that do "pretty fair" work. But not everybody wants that kind, and there are enough people who want the best, to keep Whitney good and busy all the time.

Whitney's P-4 Planer is a machine you ought to know about. Whitney's book tells all about it and is yours for the asking.

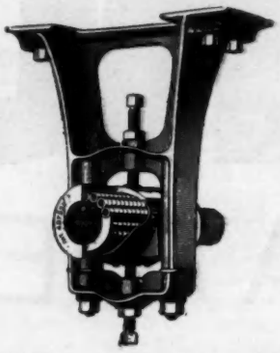
Baxter D. Whitney

Winchendon, Mass. U. S. A.

Special Machinery

DESIGNED AND BUILT.
HEAVY WORK DESIRED.

Brandywine Machine Works,
WILMINGTON, DEL.



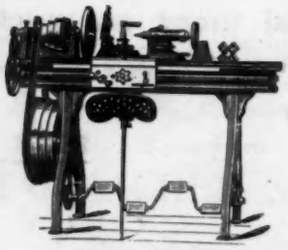
"An Innovation."

All useful things have been an innovation at some time, but the fact that a thing is not in general use is no reason why it should be condemned or left for your neighbor to both try and reap the benefit of. Do not make a superficial investigation of the merits of the Spiral Roller Bearing, or accept negative testimony. The testimony of the witness who was not present, nor of the buyer who never purchased any of the goods, has no weight in a court of law.

SEND FOR OUR BOOK.

The Hyatt Roller Bearing Company,
HARRISON, N. J.

133 Liberty Street, New York.



9 in. to 13 in. swing.

FOOT POWER LATHES

FOR THE
ELECTRICIAN,
EXPERIMENTER,
BICYCLE REPAIRING,
GENERAL MACHINE SHOP WORK.

Send for Catalog.

W. F. & JNO. BARNES CO., 1995 Ruby Street, Rockford, Ill.

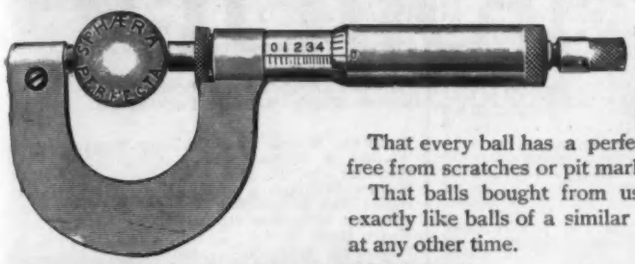
CHAS. CHURCHILL & CO., English Agents, LONDON, E. C.

Iron Working Machinery,
For Immediate Delivery.

W. R. Colcord Machinery Co.,

423-425 N. SECOND ST., ST. LOUIS, MO.

Steel Balls. . .



We Guarantee

That every ball is **a perfect sphere.** That every ball is within $\frac{1}{10,000}$ **of an inch** of exact size.

That every ball has a perfectly smooth surface, free from scratches or pit marks.

That balls bought from us at one time will be exactly like balls of a similar size bought from us at any other time.

The STEEL BALL COMPANY, Chicago, Ill., U. S. A.

Death and Taxes

Are generally regarded as the surest of all sure things. Here's another thing that's equally sure: For certain kinds of work requiring unerring accuracy, and rapid, economical handling, no lathe ever built can compete for a minute with a Landis Grinder.

That may seem to be a strong statement, but it won't after you've read our catalog and considered the other evidence we're ready to present.

LANDIS TOOL COMPANY,

Waynesboro, Pa., U. S. A.

Walter H. Foster, Manager, New York. Hill, Clarke & Co., Boston and Chicago. C. W. Burton, Griffiths & Co., London. Ad. Janssens, Paris. Schuchardt & Schutte, Berlin, Vienna and Brussels.

Leviathan Belting.

Tested under the hardest possible conditions and proved by years of service to be the best belt

For Heavy Driving of all Kinds.

Proof against Heat, Steam and Water. Strength, Durability and Traction Power Unequaled

SOLE MANUFACTURERS:

Main Belting Co.,

1219-1235 Carpenter St., Philadelphia.
55 & 57 Market Street, Chicago.
120 Pearl St., Boston.

Send for Price Lists and Samples.

Way Back In 1875

the Committee of U. S. Supervising Inspectors, appointed to test Safety Valves, said in their printed report to the Board: "That they have no hesitancy in reporting that among the very efficient instruments, the Crosby was one of the **most** efficient."

That was twenty-three years ago, mind you, and Crosby Valves have more than kept up with the procession in the way of real improvements.

Our Gages and Valves have been approved and adopted by the Navy Department, the Board of U. S. Supervising Inspectors of Steamboats, and the Secretary of the Treasury. It's useless to look for better, for the simple reason that there isn't any better.

We also make Steam Engine Indicators, Recording Gages, Chime Whistles, Branden Pump Valves, Lubricators, Gage Testers, Feed Water Regulators, etc., all of which have to come up to the Crosby Standard before leaving our factories.

Our Catalog is free to interested persons.

Crosby Steam Gage and Valve Co.,

Office and Works,
BOSTON, MASS., U. S. A.

97 Oliver Street, Boston, Mass.
78 John Street, New York, N. Y.
21 and 23 W. Lake Street, Chicago, Ill.
75 Queen Victoria Street, London, England.

Index to Advertisers.

	PAGE
Acme Machinery Co	16
Adams Co., The	51
Albro-Clem Elevator Co	10
Almond, T. R	47
American Emery Wheel Works	41
American Gas Furnace Co	2
American Tool Works Co	48
Armstrong Bros. Tool Co	13
Arthur Co., The	38
Backus Water Motor Co	47
Baird & Co., Henry Carey	3
Baird Machinery Co., U	52
Baker Brothers	3
Baldwin, Davidson & Wight	6
Ball Bearing Co	16
Barnes & Co., W. F. & John	2 and 15
Beaman & Smith	37
Becker Mfg. Co., John	15
Bement, Miles & Co	14
Besly & Co., Chas. H	56
Bethlehem Foundry & Machine Co	54
Bethlehem Iron Co	55
Bickford Drill & Tool Co	49
Bignall & Keeler Mfg. Co	14
Bilgram, Hugo	9
Bliss Co., E. W	6
Boston Gear Works	47
Bradford Mill Co., The	53
Brandywine Machine Works	2
Bristol Co	56
Brown & Sharpe Mfg. Co	56
Brown & Co., R. H	9
Brown & Zortman Machinery Co	12
Buffalo Forge Co	56
Bullard Machine Tool Co	4
Bullock Electric Mfg. Co	38
Burt Mfg. Co	38
Caldwell Co., W. E	54
Carborundum Co., The	40
Card Mfg. Co., S. W	40
Case Mfg. Co	51
C & C Electric Co	45
Chandler & Taylor Co	54
Chicago Pneumatic Tool Co	5
Cincinnati Mach. Tool Co	6
Cincinnati Milling Machine Co	50
Cincinnati Planer Co	10
Cincinnati Radial Drill Co	41
Cincinnati Shaper Co	16
Cleveland Ball & Screw Co	49
Cleveland Gear Works	38
Cleveland Machine Screw Co	4
Cleveland Twist Drill Co	56
Clough, R. M	55
Coal Handling Mach. Co	54
Coffin & Leighton	15
Colcord Machinery Co., W. R	2
Columbus Machine Co	54
Cook Co., Asa S	9
Crescent Steel Co	6
Crosby Steam Gage & Valve Co	7
Cumberland Iron & Steel Shafting Co	41
Curtis & Co., Mfg. Co	47
Curtis & Curtis	4
Cushman Chuck Co	9
Dallett & Co., Thomas H	49
D'Amour & Littledale Mach. Co	3
Davis Machine Co., W. P	16
Dayton Globe Iron Works Co	54
Detrick & Harvey Machine Co	51
Diamond Machine Co	4
Dietz, Schumacher & Boye	48
Dixon Crucible Co., Joseph	14
Doan & Co., J. B	12
Draper Machine Tool Co	45
Dreses, Mueller & Co	50
Dwight Slate Machine Co	55
Eames Co., G. T	51
Eddy Electric Mfg. Co	3
Errington, F. A	9
Evans Friction Cone Co	41
Falkenau, A	3
Faneuil Watch Tool Co	56
Fellows Gear Shaper Co	49
Fifield Tool Co	56
Flather & Co	16
Foos Gas Engine Co	54
Fox Machine Co	16
Frick Co	54
Garvin Machine Co., The	48
General Electric Co., The	13
Geometric Drill Co	9
Gisholt Machine Co	1
Gleason Tool Co	56
Goodyear, S. W	4
Gould & Eberhardt	16
Grant Gear Works	16
Gray Co., G. A	16
Haasenstein & Vogler	13
Hamilton Machine Tool Co	55
Hammacher, Schlemmer & Co	40
Hampden Corundum Wheel Co	9
Harrington, Son & Co., Edwin	45
Hart Mfg. Co	55
Hartford Steam Boiler Insp. & Ins. Co	41
Heald & Son, L. S	5
Henderer's Sons, A. L	46
Hendey Machine Co	39
Hill, Clarke & Co	13
Hoggson & Pettis Mfg. Co	9
Horton & Son Co., E	9
Howard Iron Works	55
Hunt Co., C. W	14
Hurlbut-Rogers Machine Co	38
Hyatt Roller Bearing Co	2
Ingersoll-Sergeant Drill Co	47
International Correspondence Schools	55
Jenkins Brothers	40
Jones & Lamson Machine Co	16
Kempsmith Machine Tool Co	4
Keuffel & Esser Co	51
Klinefelter, J. A	12
Landis Tool Co	7
Le Blond Machine Tool Co., R. K	56
Le Count, Wm. G	9
Leffel & Co., James	54
Lodge & Shipley Machine Tool Co	12 and 51
Long & Allstatter Co	5
Lucas & Gliem	16
"Manufacturer"	12
Main Belting Co	7
Marshall & Huschart Machinery Co	13
McCabe, J. J	12 and 13
Mergenthaler & Co., Ott	44
Michigan College of Mines	56
Mietz & Weiss	54
Moffett Bearing Co	38
Morse Twist Drill & Mach. Co	15
Morse, Williams & Co	42
Morton Mfg. Co	51
Mossberg & Granville Mfg. Co	38
National Pneumatic Tool Co	53
Newark Machine Tool Works	16
New Era Iron Works	54
New Haven Mfg. Co	43
New Process Raw Hide Co	6
Newton Machine Tool Works, Inc	11
Niagara Machine & Tool Works	15
Nicholson & Co., W. H	55
Nicholson File Co	40
Niles Tool Works Co	12
Norton Emery Wheel Co	47
Oesterlein Machine Co., The	16
Oster Mfg. Co	51
Pearson Machine Co	56
Phosphor-Bronze Smelting Co	9
Pierce Engine Co	54
Pond Machine Tool Co	41
Pond Machine Co., L. W	50
Potter & Johnson Co	6
Powell Planer Co	40
Pratt & Whitney Co	50
Pratt Chuck Co	42
Prentiss Tool & Supply Co	12
Purdue University	47
Putnam Machine Works	16
Q & C Co	49
Quint, A. D	38
Reed Co., F. E	47
Reeves Pulley Co	10
Reinecker, J. E	43
Rogers Boat, Gage & Drill Works, John	46
Rue Mfg. Co	54
Safety Emery Wheel Co	51
Saunders' Sons, D	10
Sawyer Tool Co	14
Sebastian Lathe Co	4
Sellers & Co., Inc., William	16
Seneca Falls Mfg. Co	10
Shultz Belting Co	16
Sibley & Ware	47
Sittman & Pitt	6
Skinner Chuck Co	9
Slocomb & Co., J. T	47
Smith & Mills	15
Snyder, J. E	47
Speirs & Co., J. C	6
Spencer Auto. Mach. Screw Co	53
Springfield Gas Engine Co	54
Springfield Machine Tool Co	53
Standard Tool Co	9
Starrett Co., L. S	14
Steel Ball Co	7
Stevens Arms & Tool Co., J	14
Stiles Press Co., E. S	52
Stover Novelty Works	4
Stuart's Foundry & Machine Works, R. J	56
Syracuse Twist Drill Co	47
Terry Engraving Co	3
Tight Joint Co	55
Toomey, Frank	12
Towsley & Co., J. T	9
Trump Brothers' Machine Co	9
Turner, Vaughn & Taylor Co	6
United Correspondence Schools	38
United States Metallic Packing Co	49
Waltham Watch Tool Co	10
Warner & Swasey	56
Watkins Co., F. M	54
Watson-Stillman Co., The	41
Weber Gas & Gasoline Engine Co	54
Webster Mfg. Co	54
Wells Bros. & Co	56
Whitcomb Mfg. Co	6
Whitney, Baxter D	2
Whitney Mfg. Co	45
Whiton Machine Co., D. E	3
Wiley & Russell Mfg. Co	10
Wiley & Sons, John	40
Williams & Co., J. H	13
Windsor Machine Co	44
Winkley, F. D	16
Wood's Sons, T. B	15
Woodward & Rogers	10
Worcester Machine Screw Co	14
Worcester Polytechnic Institute	41
Wormer Machinery Co., C. C	13
Wyke & Co., J	54
Wyman & Gordon	56
York Co., S. M	12
Young Mfg. Co., W. C	4

Contents.

	PAGE
Co-operation in Cost Reduction	17
Compressed Air to Save Ships. By Frank Richards	17
Machine Tools at the Paris Exposition	18
Commercial Review	19
Improved Bement Horizontal Boring Machines	20
Machine Tools—VI. By John Richards	22
Rolling Mill Fly-Wheels. By John Fritz	24
The Shops of the Landis Tool Company—II.	26
A Picture from Cavité	31
Drawing Rectangular Shells. By Geo. B. Painter	31
A Large Award for the Use of a Valuable Invention	32
A New "Power Economizer."	32
An Improved Jack Screw	32
The Work of the Small Shops—A Screw-Cutting Rig for the Shaper	32
A Decade of Progress in Reducing Costs	34
A New Steam Engine Indicator	34
Letters from Practical Men: Foreign Shipments. By Wm. C. McLeod... Wasting Wind is Wasting Windmills. By Tecumseh Swift....Photographed Reference Drawings. By F. H. S....Cast Iron Dies. By Ezra Estep	35-36
A New Induction Coil	37
Personal	37
Fraudulent Use of a Letter	38

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 22 NEW YORK, THURSDAY, JUNE 1, 1899 NUMBER 22

Published at 218 William St., New York
Every Thursday by the

American Machinist Press.
[INCORPORATED.]

JOHN A. HILL, President and Treasurer.
A. LEIGHTON DONNELL, Sec'y.

Editorial Department.
FRED J. MILLER, Chief.
FRANK RICHARDS, F. A. HALSEY, EDWARD P. BUFFET. } Associate Editors.

Advertising Department.
C. P. DAY, Eastern Representative.
JOHN MCGHIE, Western Representative.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Never address individuals, send all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price.

$3 per year in advance, postage paid in North America.
$4 per year in foreign countries, postage prepaid.
No back Numbers beyond current year.
For Sale by Newsdealers, generally.

CHAS. CHURCHILL & Co.,
9 to 15 Leonard St., Finsbury, London,
Agents for Great Britain.

FENWICK FRERES & Co.,
21 Rue Martel, Paris,
Representative for France, Belgium, Switzerland and Italy.

Entered at New York P. O. as second-class mail matter.

Co-operation in Cost Reduction.

The paper entitled "A Decade of Progress in Reducing Cost," of which we give a rather meager abstract in another column, may be regarded in different ways by different readers, and some, perhaps, may fail to learn the lesson of it. The paper deals with the cost of production of pig-iron under two or three different sets of conditions, of the cost of producing Bessemer ingots, of the cost of converting the ingots, the cost of rolling wire rods from billets, of mining coal and producing coke, of smelting lead. Concerning each of these in the decade just closed, the paper shows a quite astonishing reduction in cost. Some may be satisfied to have these facts presented to them so strikingly, but, to our thinking, the paper is of much more importance for suggesting the means and the course of progress rather than for the mere statement of the actual advance accomplished. We deal usually with other matters than those of the blast-furnace, the coke oven or the lead mine, but the lesson of success there is a welcome enforcement of the lesson that is also needed in the machine shop, the foundry, the blacksmith shop, the boiler shop, the drafting room, the business office, or whatever has to do with general machinery production and operation. The simple lesson is, that the advance must be all along the line, as it most notably has been in the cases cited in the paper referred to. There is no striking advance for any single responsible detail of operation. No revolutionary invention, no great change in process has transformed the work. The costs have not been knocked off in big chunks, but in minute fragments. The cost reduction has been here a little and there a little. No one man and no department may seem to have done much, but, each contributing, the total is something for high congratulation. Eternal vigilance is the price of many things besides liberty. It is notably the price of economy, of sustained excellence, of continued success in any line, and for all the phrase is insufficient. Economy must be not only eternal, or continually persistent, but it must at the same time be ubiquitous or all embracing. In the reduction of the cost of pig-iron, as detailed in the paper, the reduction is distributed over more than a half a dozen particulars, and finds some portion of its total in each. Then in another place in the paper one of these items, the cost of coke, is spoken of separately, and its reduction is attributed to a dozen different contributing causes; and so of the others, the details of each may be followed into still minuter details, and the possibilities of saving something may be found in the least and most remote of them. So in all of our machines and machine products, there is not only actual reduction of cost continually going on, but also an equally continuous improvement in the thing produced. It is, on the average, better as well as cheaper. For less cost we get better quality. To this improvement also the many rather than the few or the solitary ones contribute the most, and in the multitude of helpers, in the co-operation of the many, are the hope and assurance of still further progress. A thousand pairs of eyes intently seeking, and a thousand pairs of hands extended all around to grasp what comes in their way, do not watch and reach for nothing. There are as big fish and as many fish still swimming to our nets as have ever been caught.

Compressed Air to Save Ships.

BY FRANK RICHARDS.

As I write these lines an object lesson for the engineers of the world is in progress. One of the great ocean liners is fast on the rocks of Cornwall, and before these same lines greet the eye of the reader the fate of the Paris may be decided. Whether she is saved or lost the lesson remains, and may be made of more value than that of many ships.

The Paris is built with the usual safety device of watertight compartments, which have already once saved her, and have also been effective in many other cases. The number of her compartments is, I believe, at least a dozen. There are big holes knocked in the bottom of the ship, and the water enters freely into one or two compartments, so that it is impossible to pump them out. The absurd attempt is being made to pull her off the rocks with these same compartments full of water to the level of the sea outside, although she went on at nearly high tide and under considerable headway. The filled compartments are forward and among other devices, it is, at this writing, proposed to fill some of the after compartments with water for the purpose of lifting the bow.

The event may be against me, but these proceedings seem absurd. There is a means of expelling the water from the filled compartments so obvious, so indisputably adapted to the purpose, and so certainly effective that it seems unaccountable that some engineer has not suggested it before this. Close the hatches of the flooded compartments and drive the water out by forcing air in. As a pressure of 1 pound of air (or of anything else) more than balances two feet of water, a pressure of 10 pounds would more than balance and expel the 18 feet of water said to be in the hold. It is not necessary to speak of any of the details of the application, as any engineer should be competent to look after them. It would not, of course, make the slightest difference how big the holes might be in the bottom, as the water would be expelled and kept out on the same principle as in the old-fashioned diving bell. The pressure against the bulkheads could be met by timbers extending from one to another. The deck should certainly be strong enough to resist the upward pressure. The pressure could never be greater than just sufficient to expel the water, as the surplus of air would at once begin to follow it and escape. There should not be any difficulty, either, for an emergency like this, and with compressed air in such wide use, in finding air compressors, or even blowing engines, that in a few hours could be rigged to supply the air. With a

copious supply of air the safety of the vessel could be assured between tides.

The saving or the loss of the Paris becomes a trivial and a transient matter in itself in comparison with the larger lesson which her predicament enforces. Beyond the device of the separating bulkheads, when their doors are happily closed and they are strong enough to resist the pressure, the one solitary hope for a leaky ship is pumping. It is a fight at once between the leak and the pump, and only comparatively small leaks are defeated by the pump. The saving efficiency of the pump is not the full capacity of it, but only the difference between its capacity and that of the leak. If the leak rate is nine and the pump rate is ten there is some hope that the pump may win, but it all depends upon the prolonged maintenance of the one-tenth of excess. The pumping out of a leaky ship is a very different thing from pumping out a tight one. The work is not only so enormously wasted while it is going on, but it never is finished. The necessity for pumping is as unrelenting after hours or days of work as at the beginning.

In the use of air pressure for expelling water there is none of this wasted work. All of the air pressure applied above the water is effective in driving it down. The leak is stopped the instant the pressure above the water is sufficient to balance the pressure that is driving it in. Supposing the ship to be afloat, and not on the rocks, she is saved at that moment. The expulsion of the water after that is only a question of time, and not one of uncertainty or of anxiety; and after the water is expelled there is nothing more for the air compressor to do but to maintain the pressure. As I said before, it would make no difference to the air as to how big the leak might be, and it would, of course, work a little better against a big leak than against a little one, as the water would flow out more freely. The leak against which the pump would be useless would find the air compressor at its full effectiveness.

The air would, of course, only drive the water down to the level of the leak, as it would then find its opportunity to escape; but leaks usually occur on the bottom or far below the water line. Supposing the system of air protection against leakage to be generally adopted, and provision for the employment of the air to be provided for in the design and construction of the ship, there would, of course, be air-locks provided in the bulkheads or the decks, by which men and material might enter. Men would experience no difficulty in working under the pressure required to expel the air, and would often be able to stop the leak when discovered.

Obviously the lesson which the incident of the hour should enforce is that the air compressor rather than the water pump should be employed, not merely for the present emergency, but universally in ships as a cheaper and vastly more efficient protection. The use of compressed air for water expulsion should be provided for in the construction of the ship, especially in the staying of the decks and bulkheads, and in the construction of an occasional air-lock instead of single doors or hatches. No elaborate system of piping would be required, as air hose would be preferable and could be carried wherever wanted. The compressors would cost no more than the pumps which they would supplant. In the navy, where the employment of compressed air for auxiliary power transmission is still debated, this one use of the air should be an overwhelming argument for its installation.

Machine Tools at the Paris Exposition.

A meeting of the manufacturers of machine tools and allied lines of machinery was held May 17, at the rooms of the Commissioner General of United States, for the Paris Exposition of 1900, in the Equitable Building, New York City, to consider matters of importance relating to the American machine tool exhibits at the coming World's Fair. A proposition that American tool builders increase their exhibition space by the erection at their own expense of an additional building, to be located at Vincennes, seven miles from the Champ de Mars, where the main buildings are situated, was laid before the meeting by Mr. F. E. Drake, director of American machinery and electrical exhibits, and an informal vote taken upon the question passed without dissent. A meeting of Western tool men was held for the same purpose in Chicago, May 23, and with a like result. It is therefore not unlikely that the project will be pushed to fulfilment.

The allotment of space at the Champ de Mars for American machine tools (including accessories, machinists' hand tools and wood-working machinery), together with steam and other engines and electrical and general machinery, amounts to about 23,000 square feet of floor space, net—that is, exclusive of aisles, etc. Making a division with the electrical machinery, etc., will leave for machine tools not more than 11,500 square feet. Besides this there is open to these industries 5,000 square feet for historical and non-commercial exhibits, and also a gallery which will be used for American electrical apparatus, and perhaps also for some of the smaller goods classified among machine tools. For sections of the limited space available by tool manufacturers about 125 applications have been put in. In the aggregate they call for some 90,000 square feet, even after some of the most exorbitant demands have been cut down to a more reasonable figure; as was done in the case of one company which requested 30,000 square feet, but the estimate was reduced by the machinery commission to 5,000 feet before it could even be seriously considered. If the applicants for space should be allotted equal sections each manufacturer would receive an area less than ten feet square.

Under these embarrassing conditions Mr. Francis E. Drake, the director of the American machine tool and electrical exhibits, is doing all in his power to secure for American too' builders an apportionment of space sufficient at least for necessities, and has hit upon the scheme of the erection by these manufacturers themselves of an annex at Vincennes. He returned, May 2, from a trip to Paris, made particularly in order to obtain additional space for the tool builders, which resulted in a concession to erect such a building. Preliminary plans have already been drawn up.

The objection of distance from the Champ de Mars, which is sure to be raised against the occupation of a building at Vincennes, is answered by showing that it has already been determined to locate at Vincennes the railway exhibits, with those of electric and compressed-air traction, automobiles, bicycles, boats of various kinds, electric vapor launches and agricultural machinery. These industries include those from which a large part of the European demand for machine tools is derived; hence, few probable buyers of tools would visit the Exposition without going to Vincennes. The auxiliary grounds are easily reached from the Champ de Mars by the Orleans railway or by boat on the Seine.

The expense of erecting the auxiliary building will not be assumed by the French Government, and the fund appropriated by the United States Government for exhibition purposes is not sufficient to warrant the outlay. The assumption of the expense by the tool builders, however, is less of a drawback to the project than would appear at first blush. Although exhibition space on the main grounds is nominally free, there are many incidentals, such as flooring, platforms, railings and piping, which must be borne by the exhibitors, and which, all told, will amount to about $1 per square foot. As the estimated cost to exhibitors of the new building, including such odds and ends as those above mentioned, is estimated at not more than $1.25, the difference will not be great.

At the meeting held May 17, were present representatives from forty-one manufacturing companies of the East, and in some cases as far West as Ohio. They were in great part machine tool makers, although some manufacturers of other lines, such as valves and belting, were included. The matter of the new building was fully laid before the meeting by Mr. Drake and his assistant, Mr. Jas. S. Anthony, and was freely discussed by the gentlemen present. While the majority would have preferred to obtain space exclusively at the Champ de Mars, an informal vote of approval of the Vincennes

project was taken without dissent. The plan drawn up for the new building was submitted. It was explained that this would give additional space to the amount of 19,000 square feet gross, or 13,500 net, making, with the allotment at the Champ de Mars, about 25,000 square feet net. A suggestion that a further increase be made by putting a second story in the Vincennes building was approved, and the drawings will be altered accordingly. A third story was suggested, but the proposition was rejected on the ground that it probably would not be allowed by the French authorities and that it would make an unsightly structure.

A feature of the arrangement of exhibits which may cause some dissatisfaction, but which is believed to be the most equitable under existing circumstances, will be the regulation that tool manufacturers must divide their exhibits between the Champ de Mars and Vincennes. At the former place they may put two or three of their most imposing machines, with a desk, advertising literature, etc., while at the latter their machinery may be shown in operation. This rule will not, however, be enforced where it would manifestly be inexpedient—as, for instance, where a manufacturer's exhibit consists of fine tools in a show-case.

Many of the machine tools at the exposition are to be driven by direct-connected motors. It is said that the exhibits of one of the largest Western heavy tool companies will probably be thus arranged in every instance.

It is not to be wondered that much dissatisfaction exists in the machine tool trade over the amount of space obtainable. This is an incident to every exposition, and there is probably no more trouble now than there was at the time of the Chicago fair, if there is as much.

It is true that in the present case exists a somewhat unusual hardship in the isolated location of the proposed Vincennes building, but it is not a sufficient reason for manufacturers to forego their purpose of exhibiting and to sulk at home, as is the disposition shown by a representative of one concern whose absence from the exposition would leave a wide gap in the American machine tool ranks at Paris. There is nothing to be gained, and much to be lost, by such contempt of facilities for trade extension. The holding aloof of any manufacturer would be of advantage to none but his competitors, who would naturally be grateful for the space left vacant by him.

The Commission recognize the fact that machine tools will be one of the most important lines of American exhibits at the fair. If there is a poor showing it will not be their fault.

Mr. Drake deserves the gratitude of tool manufacturers for the fight he has made for their interests against strongly adverse conditions and for the fair measure of success he has attained.

Commercial Review.

NEW YORK, FRIDAY EVENING,
May 26, 1899.

THE ENGINE MARKET.

Contracts are being placed about as extensively as in past months. Many manufacturers are so crowded with work and sold out for so many months ahead that their representatives have to let orders slip into the hands of competitors better able to meet the requirements. There is an especially heavy demand for large engines, and some contracts for exceptionally big units have just been awarded. One of these, which was taken by the E. P. Allis Company, calls for two engines of 4,000 or 5,000 horse-power for the Boston Elevated Railway. Contracts for several 2,500 horse-power engine units and a boiler equipment for a lighting plant have been placed elsewhere. Deliveries of Corliss engines are becoming increasingly long. Prices, both of Corliss and of high-speed engines, continue to be advanced in this or that quarter almost all the time, so that the average price may be said to be continually on the upward move, and it is predicted to go still higher before the summer is over. The advance on Corliss engines, where the material is more costly in proportion to the labor, naturally rules greater than on high-speed. But labor itself is tending upward, since the workmen look for higher pay with higher prices. Figures on engines are generally named subject to change at any time. An engineering firm who have frequent occasion to buy engines state that ten days' option is the longest they can obtain. The New York manager of one company tells us, however, that he is allowing thirty days.

High-speed engines, too, are in heavy demand; but whether to the same extent as earlier in the spring is disputed. Large office building erection in this city is not active, but there is something doing in the hotel and apartment house line. Three engine contracts lately given out are as follows: For the Seminole apartment house, Broadway and Seventieth street, two Ames engines and Crocker-Wheeler dynamos; for the Thorley building, Broadway and Forty-second street, to be used as a hotel, two Ames engines and Westinghouse generators; for the Matthew Byrnes Estate hotel, Fifth avenue and Forty-fifth street, American Ball engines.

The American Ball Engine Company expects to place its factory upon double turn next week.

MISCELLANEOUS.

There is a vigorous outcry among buyers of steel plate adapted to boiler, tank and kindred purposes, because some of the mills which are sold out many weeks or months ahead are offering to make early deliveries for a bonus. This premium was found in one case to average a tenth of a cent per pound per week of expedition. We learn that a certain party who was placing an order with one of the mills withdrew it upon learning of this policy. With the present congested state of the plate mills an offer of quick shipment at a premium is strong evidence of unfair dealing, since it must involve a sacrifice of the interests of customers whose orders are already on the books and who are entitled in business honor, at least, to be served in their turn. Whoever has such an order made to him may well be reluctant to continue dealings with the mill, for he may be sure that his own order will be pushed aside where it suits the convenience of the company to do so. More than one party has broached the subject of agitating a removal of the present duty from plates if this state of affairs proves chronic.

The plate situation has caused an engineering firm who were planning to erect a steel smoke stack to decide upon a brick one instead.

The Brown Hoisting & Conveying Machine Company is constructing fifteen or twenty big cranes for Europe. It is also building six coaling stations for the United States Navy, which are said to be the first ones involving the extensive use of machinery that our Navy Department has ever ordered. One of the European governments is negotiating with the company for the construction of a coaling station. The works are running in part upon night turn. The volume of contracts on hand is extraordinary.

The North Carolina Power Company, in which Dr. Dillon Brown, of New York, holds the chief interest, and for whom J. G. White & Co. are the engineers, proposes to utilize by electric transmission the power of the Yadkin River, in Stanley County, North Carolina. The company owns twelve miles of the river, in which distance there is a total fall of 230 feet. The minimum flow amounts to nearly 2,500 second-feet, approximately 60,000 horse-power, and of this it is proposed to develop 20,000 horse-power at the first installation. The current will be transmitted to Charlotte and to such cotton mills as will purchase power. The engineers have five topographical surveying parties in the field and have established camps to expedite the work. The scheme of development will depend upon the results of the survey.

J. G. White & Co. are also preparing, on their own account, to erect in Porto Rico an electric plant, from which current will be taken to operate a road which extends out from San Juan, now run by steam. The cars to be used on this road will be of a type especially designed for the purpose, open ones with cane seats and easily cleaned. The cars used in the United States, even in the tropical regions, were found not to be quite adapted to Porto Rican conditions.

The Albany Boiler Works' plant burned down May 11, as a result of night work, a torch having been dropped upon an oil

barrel. May 24 the company bought and took possession of the Franklin Iron Works, Green Island, opposite Troy. The machinery equipment already in place there, together with what was saved from the old plant and has recently been purchased, constitute a boiler plant which is claimed to be excelled by none in New York State.

The Gates Iron Works, Chicago, have secured a large contract for stone crushing, pulverizing and other machinery for a cement plant to be erected at La Salle, Ill., by the Carl Prussing Cement Company, of Germany.

The Pneumatic Supply & Equipment Company, New York, recently organized, has received from the Tubular Dispatch Company, owning and operating the pneumatic mail transmission tubes in this city, an order for three air compressors, the capacity of each of which is in excess of 1,300 cubic feet of free air per minute.

Attention is called to the notice in another column of a contradicted report that Bement, Miles & Co. have been consolidated with the Niles Tool Works Company.

CHICAGO MACHINERY MARKET.

Three of the large sellers of electrical machinery in this market have advanced prices. Other manufacturers are selling at the old quotations. This partial change in values is somewhat diverting the business from its former course, but the makers who are stronger in their quotations have all the business they can look after, and are not disconcerted at the decrease in the new business they are booking. In fact all sellers of electrical machinery report a very satisfactory condition of the market. The advancing tendency of prices has its basis in the increased cost of material, especially copper. There is now every assurance that the electrical machinery makers will have a busy summer. There is enough large work contracted for already to keep the shops busy for several months, and the usual amount of small work is all that is necessary to maintain full activity. It is only the small motors and generators that can be supplied with any degree of promptness. Makers in some instances have broken stocks even of the small power machines, and the buyer often has to shop around before he finds what he wants.

Trade in electrical machinery is reported to be even a little better than a month ago. Inquiries are rather more numerous and sales are slightly larger. Street railways continue to be the most prolific class of buyers, but the shops are also in the market for a very fair share of equipment. One sale made last week was for shipment to Australia.

The Siemens & Halske Electric Company has begun on a small scale the manufacture of automobile motors. It is increasing the force of men gradually. Among orders recently taken are generators and motors for the street electrical companies at Wooster, Ohio, at Erie, Pa., and at Springfield, Mass.

The Crocker-Wheeler Company has sold a 200 horse-power generator and motor of equal size to the Schwarzchild & Sulzberger Packing Company, St. Louis, Mo.; also an electrical outfit of the same power to the Kansas State penitentiary, with which to equip the new plant for making binding twine, a product that is intended for the farmers of only that State.

In all branches of the finished iron and steel industries activity is greatly hampered by the insufficiency of material. Complaints to that effect are very common among the Western shops. The delays are more marked for the crude forms of iron and steel material than for machines and tools. In addition to the scarcity, the prices are steadily advancing. The rise has had no appreciable effect as yet in reducing the consumption of the products. Demand is everywhere very active, in excess of recent experience and in excess of the power of the makers to produce.

Quotations.

NEW YORK, Monday, May 29.

Iron — American pig, tidewater delivery:—

Pennsylvania irons:	
No. 1 X foundry	$16 75 @ 17 25
No. 2 X foundry	16 00 @ 16 50
No. 2 plain	15 50 @ 16 00
Gray forge	15 00 @ 15 50
Alabama irons:	
No. 1 foundry	16 25 @ 16 75
No. 2 foundry	16 00 @ 16 25
No. 3 foundry	15 50 @ 15 75
No. 1 soft	16 25 @ 16 75
No. 2 soft	16 00 @ 16 25
Foundry forge	14 75 @ 15 00

Bar Iron—Refined, 1.75c. and upward for base sizes on dock; 1.90c., upward, from store.

Tool Steel — Base Sizes — Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 2.20 @ 2.50c.

Cold Rolled Steel Shafting—Base Sizes, from store, in small lots, 3¼c.

Copper—Carload lots, Lake Superior ingot, 18 @ 18¼c.; electrolytic, 17⅜ @ 17⅝c.; casting copper, 17 @ 17½c.

Pig Lead—Carload lots, 4.45 @ 4.50c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 25¾ @ 26c., f. o. b. New York.

Spelter—Prime Western, in carload lots, 6.70 @ 6.75c., New York delivery.

Antimony—In cask lots and over, Cookson's, 11c.; Hallett's, 9⅞c.

Lard Oil—Prime city, present make, 42 @ 44c. for the leading brand, in wholesale lots.

Improved Bement Horizontal Boring Machines.

The machines which we illustrate herewith are of a type which has been familiar in machine shops for many years, and our present purpose is to show it in its latest form and with all the modern improvements added to it by the establishment in which it originated over thirty years ago. This machine, which is known as the Bement type horizontal boring machine, was brought out by Bement & Dougherty about 1868, and has since been extensively copied here and abroad, so that it is now one of the standard machine-shop tools.

The engravings show the latest designs of Bement, Miles & Co., of Philadelphia, and of these Fig. 1 is one of the larger sizes in its plainest form, Fig. 2 the same machine with added features, and Fig. 3 a smaller machine.

In most modern shops where such a machine as that shown in Figs. 1 and 2 would be used, it would preferably be located where work could be placed upon it and removed by an overhead traveling crane; and where this is the case the countershaft must be placed back under the gallery, or at least far enough to one side to clear the crane run-way. This calls for the belt to be run at an angle from the cone-pulley, and the former arrangement of the back-gear quill—i. e., vertically over the pulley—interfered with this. The back gears have therefore been placed forward of the pulley, and the intermediates are supported upon a stud fixed in an upward extension of the forward housing, so that nothing interferes with the belt being led off in any required direction. It will be noted in passing that the opportunity for getting in a cone pulley of large diameter is made use of, so that the belt may have driving power rather by its speed than by extreme width—a very desirable feature where a belt must be shifted by hand, aside from the fact that it avoids excessive pull upon bearings.

The general features of the machine are too well known to require description, and it seems necessary to say only that the feed motion is reversed by shifting the bevel pinions seen at the right in front of the machine—a form of reversing clutch, by the way, which, though not commonly used, is declared by Mr. F. B. Miles to be an excellent one, and in every way entirely satisfactory (even for far more severe duty than here given it) when the entering corners of the pinion teeth are thinned a little to make it engage more readily and throw the work of starting on to a point back a little from the extreme ends of the teeth.

A pull-and-push pin in connection with cone gears gives six rates of feed, and this cone-gear arrangement is connected to the bevel pinion shaft by reducing gears and a clutch, so that, altogether, twelve rates of feed are instantly available.

At present every machine sent out from

the works, as shown in Fig. 1, has planed pads, and is otherwise prepared so that at any time afterward attachments can be supplied and will fit, which attachments make it appear as in Fig. 2, where the bar is treated as a lathe spindle and will cut screws of any desired pitch. The saddle has an automatic cross-feed for milling or facing, and a circular table is mounted which may be rotated and clamped in any desired position, or may be given a continuous rotary feed motion.

By comparing Figs. 1 and 2 it will be seen that the arrangement for screw cutting consists in placing a lead screw over the bar at the rear, one end of this lead screw being journaled in a hole previously bored for it above the rear main spindle box, while the other is supported in a bracket bolted to a previously planed seat at the extreme right of the machine, which bracket also supports the change gears and swing plate and has on its front face the screw-cutting table. The seat for the open-and-shut nut is also originally planed on top of the yoke which moves the bar.

To provide for the table feeds a pad is previously planed at the side of the extension bracket which supports the bar slide,

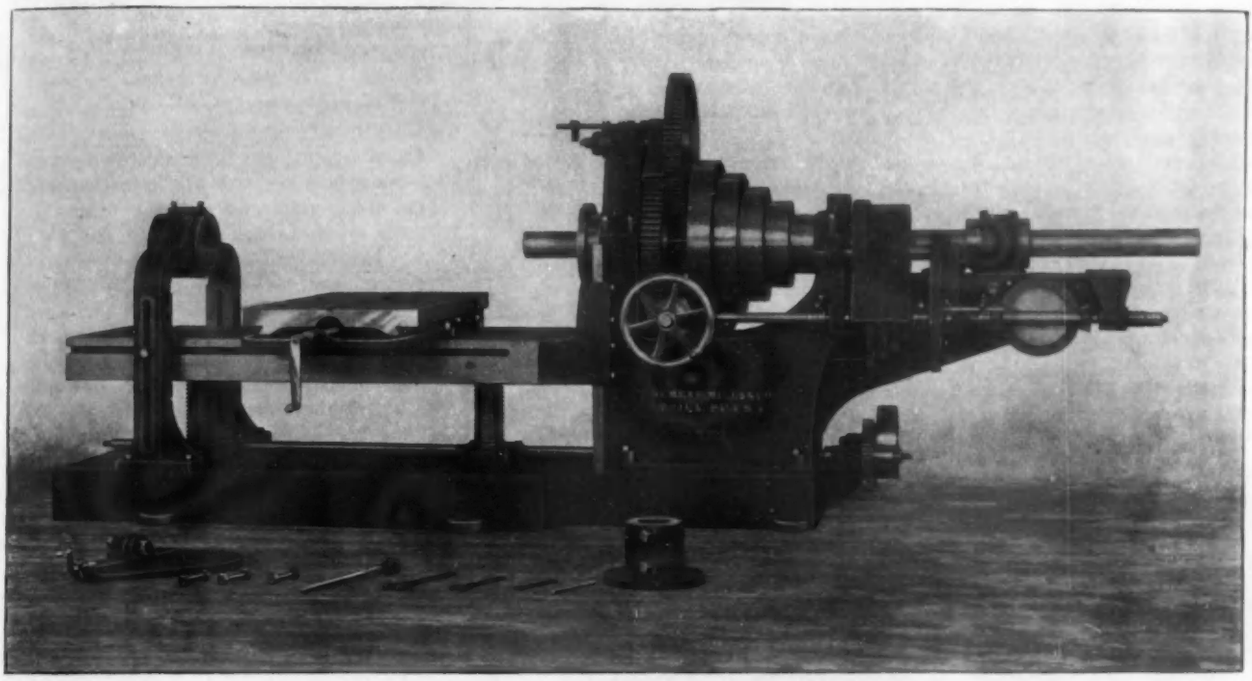


FIG. 1. IMPROVED BEMENT HORIZONTAL BORING MACHINE; PLAIN, BUT PREPARED FOR ATTACHMENTS.

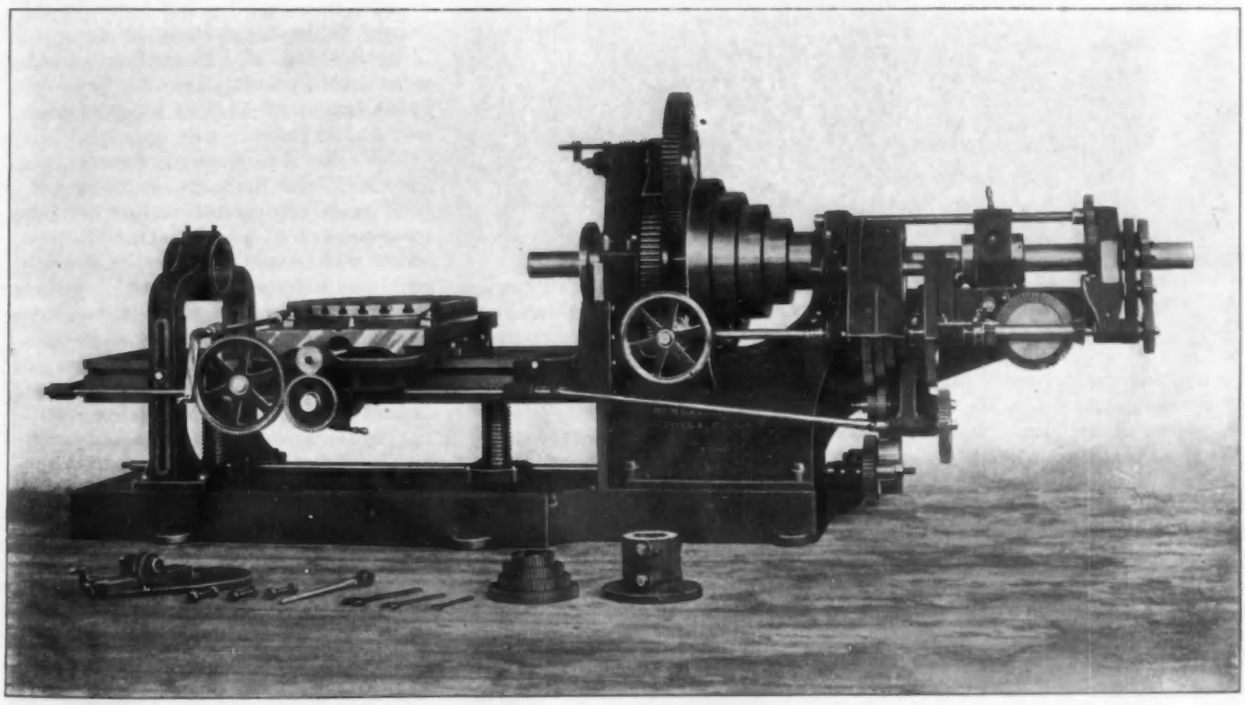


FIG. 2. BEMENT HORIZONTAL BORING MACHINE, SAME AS IN FIG. 1, BUT WITH SCREW-CUTTING ATTACHMENT, AUTOMATIC FEED OF SADDLE AND ROTARY FEED.

and in Fig. 2 this bracket is shown in place with gears for driving a feed rod through the medium of a shaft with universal joints, as shown. The feed rod passes through a splined sleeve with bevel pinions upon it, which sleeve is shifted for reversing by means of the lever seen below the table in front, and when a rotary motion is to be given the table by power a pinion is placed upon the worm shaft, which pinion engages with the large intermediate.

For the longitudinal feed of the saddle upon the table a gear is placed upon the end of the feed rod from which the saddle screw is driven, and it will be noted that this feed of the saddle upon the table enables the machine to be used in a way which entirely overcomes one of its inherent difficulties. Where the boring bar passes through the work, the latter remaining stationary, the cutter is of course constantly changing its position with reference to the points at which the bar is supported, and this inevitably causes a varying amount of spring in the bar at different points of the bore. For most work this effect is negligible, the bar being usually plenty stiff enough to bring the finishing cut within the required limit of accuracy, and of course the use of a double-ended cutter greatly lessens the difficulty in any event. But with this saddle feed the cutter may retain its position the same as is done in the lathe with a plain bar, and where a cylinder is to be bored, having one closed end, the bar may be set out far enough to reach to the bottom of the cylinder and then remain at a fixed over-hang throughout the boring operation. For this work, indeed, the bar may be dispensed with entirely if desired, and a hollow cylindrical casting bolted to the face plate, extending out far enough to reach to the bottom of the work.

Equipped in this way, it will be seen that the machine is a very complete one. It will take almost any kind of a milling cut, will bore in almost any desired manner through the work in any required direction, and where threads are to be cut concentric with the bore, these can be chased either internally or externally, the latter by means of the L-shaped cutter familiar to those who have done such work with boring bars in the ordinary lathe.

The facing arm may be bolted to the face-plate or at any point on the bar, and the facing tool is fed by a star feed.

The table is elevated either by hand ratchet for accurate setting or by power when a considerable distance is to be moved, the elevating screws being both driven from the same horizontal shaft by worm gearing, and with special provision for adjustment to preserve exact alignment of the table with the boring bar.

The frame of the smaller machine, Fig. 3, is cast in one piece; the table does not elevate by power, and there is a different arrangement of the back gears; these being made in this case so that by throwing a double-ended clutch located in front of the cone-pulley, the drive may be either direct to the sleeve within which the bar slides or through gears (covered) to the short shaft below the spindle, which carries a pinion at its outer end engaging with the spur gear formed on the outer end of the sleeve and corresponding to a face-plate gear.

The circular table shown on this machine is graduated, and can be rotated and clamped in any desired position. This smaller machine is also fitted for screw cutting attachments and the various feeds as previously described, and it will be seen that by this ingenious plan of providing for attachments which may be put on at any time, the user can, if his work or treasure box dictates it, get the plainest machine and afterwards add to it such features as may seem desirable, or may be called for; any one feature being obtainable separately or all together, as may be desired.

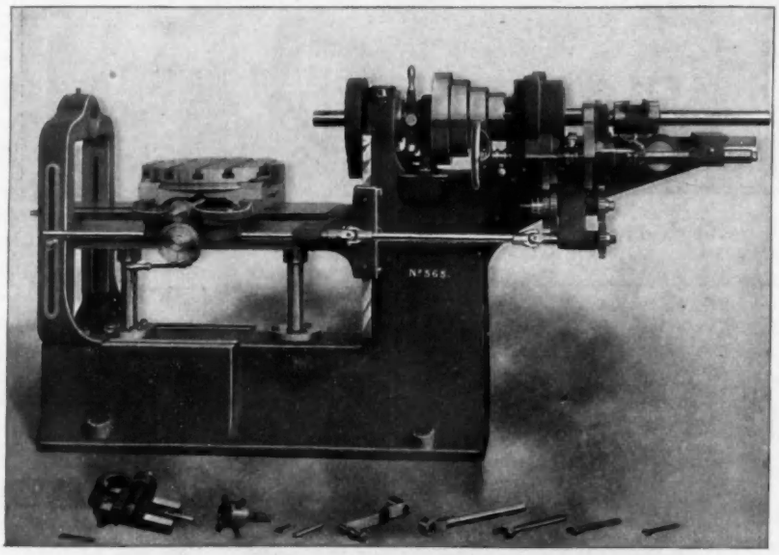


FIG. 3. SMALLER BEMENT BORING MACHINE, WITH SCREW-CUTTING GEAR AND AUTOMATIC FEEDS.

Machine Tools—VI.

BY JOHN RICHARDS.

Referring to the diagram, Fig. 39 represents in a general way a plate or web frame that has but little stability to resist torsion, only the sum of the resistance of the sides, ends and to some extent the cross girders *a*, taken in their flat plane, which is inconsiderable. Experiments to determine all this can be made with pieces of pipe, tin, or even pasteboard, which will be much more convenient than a mathematical solution of the values. Another kind of experiment still more conclusive is to lift the "corner" of a tolerably long lathe having one of these ladder frames, especially when there are four supports spread out wide on the floor. If the foundation is solid and a pinch bar is inserted under one foot, the chances are that the frame can, by its weight alone, be twisted enough to "jam" any lathe carriage that is well fitted on the frame.

One time when visiting the works of Cope & Maxwell, at Cincinnati, Ohio, where much accurate boring was done on lathes, I found the rear legs of the lathes loosened and a piece of round iron inserted between the leg and frame, at the center. These lathes stood on an upper floor, and, as Mr. Maxwell explained, this expedient was to take the twist out of the frames so the long-gibbed carriage would move freely.

It is more than twenty-five years since Professor John E. Sweet, at Sibley College, made castings of various sections corresponding to lathe frames, and determined their torsional and other strength by accurate tests, which were published but had no noticeable effect in machine-tool design. Earlier than that, perhaps thirty years ago, when contributing to "Engineering," London, a useful series of articles called "Mechanical Refinements," he explained in a complete and forcible manner the mistake of mounting lathe and other machine frames on four bearing points so as to produce twisting strain, citing the three-legged stool, which always stood without disturbing strains, a fact discovered before the pyramids were built. What Mr. Maxwell did with his lathes at Cincinnati was to eliminate the "fourth leg."

To indulge in an "invidious comparison," it may be said that if these propositions of Prof. Sweet had related to steam or hydraulic machinery, they would have been taken up and discussed all over the world, and, if found correct, adopted in a few months; but makers of machine tools do not proceed in this manner.

The idea of four or more supports for such frames as are mounted on legs, comes

from the conception of an inflexible foundation and consequent stability of any structure attached thereto; but foundations are rarely reliable, besides a great share of the machine tools in a modern establishment are set on floors that are not only unstable, but are continually changing their plane by reason of weights moving from place to place. This is one of the neglected features in practice, a

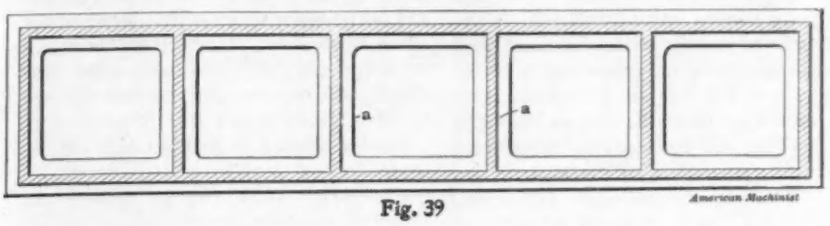


Fig. 39

case where it would cost nothing whatever to provide against a faulty working of many machines, especially small lathes and planing machines.

Torsion in machine frames is always bad, but flexure may sometimes be useful, as in the case of long planing machines, which would soon become useless for accurate work if their frames or beds were inflexible in a vertical plane. Such a machine, from the time it is put into use, begins working its ways into a curve that may be called the "trajectory of wear." This is a fact not commonly known, and will not be credited by many readers of this who have set long planing machines on carefully-made foundations and bedded the frames with mortar, lead or brimstone, so the machines would do "dead-true work." To those having these dead-true machines that have been some time in use, it is suggested that they take a cut on some stiff piece whole length of the stroke, then turn the piece on its side and stretch a fine wire along the face. The result will be astonishing. A similar test can be made by facing together two stiff wooden boards, clamping them on the planing-machine table on their edge and planing the tops with a sharp scraping tool, then placing two planed edges together to prove the straightness of the cut or the truth of the movement. I once had occasion to contract for some planing to be true within .01 inch in 20 feet. This brought out tests of machines in various shops, with the result that the work had to be done with "vertical" instead of horizontal cuts, the movement being true laterally, but with too much variation vertically. The fact is, that guiding ways for heavy platens always wear into a curve, and the best way of compensating this is by wedging up the main frame, an expedient well known to machine-tool makers who have to plane long work.

LATHE CARRIAGE WAYS.

The guiding ways for engine-lathe carriages are a fruitful subject of argument. In this country lathe carriages are commonly mounted on angular or *A* ways, which is best for some kinds of work, and in England and on the continent of Europe such carriages are usually fitted positively on the beds by angular or under gibs, which is best for other kinds of work. The correctness of one plan or the other is a matter of adaptation and compensation, also one of cost, as will be presently explained.

For all strains that fall downwards or at any angle not lower than normal to the faces of angular ways, these produce true movement, also free movement, because it is not a problem of parallel fitting, but only "face fitting" two pieces together. To this it may be objected that carriages on angular ways are usually gibbed beneath, which is true in respect to construction, but not in effect, because such gibs are not as a rule positive and fitted

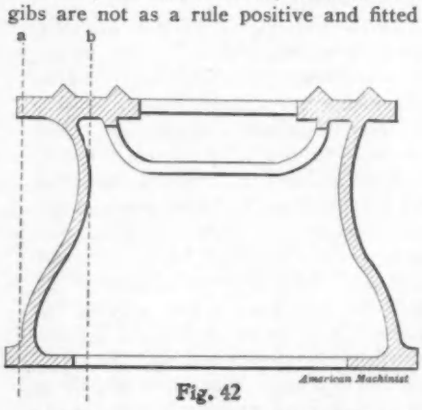


Fig. 42

ADVANTAGE OF CURVED SIDES IN LATHE BED.

from end to end, and are sometimes held by springs. Formerly weights were hung on the carriages to keep them down, all of which is right for common turning, but is equally wrong when a lathe is employed for boring or any work that develops lateral or upward strains beyond what the weight of a carriage can resist.

A portion of the lathes, perhaps half of them, in a machine works can with some advantage have their carriages fitted on top of the beds only, and on angular ways, but the other half should have their carriages fitted over the beds to resist strains in all directions.

The expense of fitting in the two cases is greatly in favor of the angular ways. This will be questioned, but never by anyone who is acquainted with what is called "getting up" lathe beds, as in English machine-tool works, or in any case where a positively gibbed carriage is to be properly fitted. It means reducing the whole of the planed surfaces from end to end to absolute flatness and parallelism. It is the difference between making a double and a single fit, that is, fitting two faces together, or fitting a third member between these faces. To put the matter into a rule, the time or the cost is as the fitted areas in the two cases, plus the work of "straightening" the gib lathe frames.

Certainly no makers of machine tools have succeeded in providing lathe carriages to move with less friction or deviation, and with more endurance than Whitworth in England and Sellers & Company in this country, who have always mounted their lathe carriages with positive gibs and broad flat bearing surfaces.

Some years ago I was obliged to change a preconceived opinion in this matter by some tests made on various kinds of lathes in a locomotive shop in Sweden, where it was found that the carriages of Whitworth's lathes, positively fitted on the beds, not only moved with greater ease but could not be shaken by means of a prying bar, while carriages on angular ways in the same shop could be moved in almost any direction by the same means.

A fair solution of this problem seems to be that in all cases when the intensity and direction of strains will not lift a carriage from its bearing, angular ways are suitable and maintain a true alignment of motion in a vertical plane, the one in which truth is most required. On the other hand, for heavy cutting, boring and all work in which the gravity of a carriage and the angle of the ways cannot resist strains directly, positive gibs are best.

As before remarked, the distinction in the two methods, in respect to fitting is greater than is commonly supposed. In English machine-tool shops* "getting up" lathe beds, as it is called, is a separate job and has nothing to do with fitting carriages on them, which is done by other workmen.

In fact the quality of machine tools that involve sliding movements is determined mainly by the flatness and parallelism of

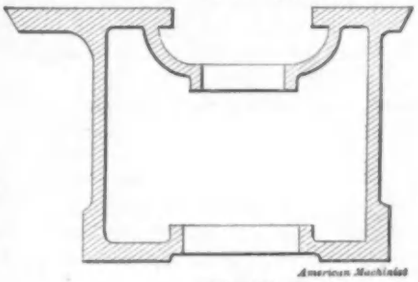


Fig. 41

CROSS-SECTION OF LATHE BED.

the sliding surfaces and the cost of preparing such surfaces is as the area so fitted.

Reverting again to lathe bed sections,

*The writer spent several years in the Manchester machine-tool district in England, and was familiar with practice there as it existed twenty years ago.

there is the inconvenience, in the tubular or box form, that chips cannot fall through the frames, but this can be avoided by providing reinforced apertures along the top and bottom of the frame, as indicated in Fig. 41, occupying about a third of the whole length, or 6 inches long, with a space of 12 inches between. This does not much affect the integrity of the box or enclosed form of bed, which can be employed alike for either gibbed carriages or for angular ways on the top.

It may be pointed out that in making girder lathe beds their torsional stability has been a good deal improved by what may be called the architectural form, the sides being molded so as to gain some rigidity by deviation from a flat section, as indicated in Fig. 42, where the portion embraced between the lines *a* and *b* is an undulating or molded plate, gaining in a degree the rigidity of the box form, but is of the architectural order and suggests chromatic hues and varnish.

Rolling Mill Fly-Wheels.*

BY JOHN FRITZ, BETHLEHEM, PA.

In the early days of rolling mills, the machinery was of the crudest character. The men who built and looked after it were called millwrights, or forge carpenters; consequently, wood was used in its construction to as great an extent as was possible. All of the earlier fly-wheels had wooden arms; at least so far as I know, and Fig. 4 shows the general way of fitting them in. They were made of hard wood, locust or white oak preferred, about 6 to 8 inches in thickness, and width as shown.

Figs. 1, 2 and 4 give the plan of securing the rims of the wheels together. The segments are in halves, and secured together with gibs and keys, same as shown in Fig. 4. Having no machine tools when these wheels were built, they were put together practically as the castings came from the foundry, with the lumps and swells chipped off with a two-handed chisel and sledge, which naturally caused a weak wheel. They were made of cold blast charcoal iron, which was greatly in their favor, and no doubt this fact prevented many accidents.

In the course of time the millwright and carpenter were displaced by the machinist, and with the introduction of machine tools, especially the planer, the wheels were better fitted up, but not much safer, in consequence of the use of iron made from mineral coal in place of charcoal.

The machinist now became the mechanical engineer, and wood not being his forte, he made the fly-wheel all of cast iron, as shown in Fig. 3. The center, arms and segments were cast separately, and had the ends of the segments been well fitted together, the wheel would have given no trouble. The slots for the tees were, unfortunately, too close to the end of the segment; the result was that they pulled the end of the casting off, and we had to chip grooves across the face of the wheel, and put heavy links around them, as shown in Fig. 2, which made a good wheel out of it. This was done in 1854, and I think the wheel so made is yet in use, but never ran at high speed.

Not considering these wheels safe, I was in constant fear of their going to pieces, which is generally attended with the most disastrous results. I abandoned entirely the old mode of making wheels, and adopted the plan of casting the center and arms together, and the rim in one piece, with lugs on the inside of the rim, as shown in Fig. 5. On the ends of the arms were pads to correspond with the lugs on the rim. When the arms were put in the rim, there was a space of about ¼ inch, in which oakum was driven tightly, which kept the arms in place. This made an excellent wheel, and in some cases wood was used to fill the space in which thin steel keys were driven. There are several of these wheels that have been in use over thirty-five years, and, so far as I know, never have given any trouble. The wheels were 20 feet in diameter, with rims about 12 inches square.

With the introduction of steel for rails and structural material, it became necessary to increase the diameters of rolls. This change necessitated heavier wheels and larger in diameter, which made it impracticable to use solid-rimmed wheels; consequently, some plan which made the parts portable had to be adopted. After much thought the plan represented by Fig. 6 was concluded to be the best and safest, and there are now a number of wheels of this type in use, varying in diameter from 20 to 30 feet. I do not know that any one of them ever has given a particle of trouble in any way, and there are a number of wheels, as per Fig. 6, that have been in use for twenty-five years, some of which have, and are daily liable to encounter, the most severe strains that it is possible for a fly-wheel to be subjected to, and are to-day apparently as safe as the day they were started.

It has been said that fly-wheels go to pieces in consequence of the irregular work, and engines driving dynamos for power purposes have been included in this class; but the strain on a fly-wheel driving a dynamo cannot be compared with that of a rolling mill. In the former the work occasionally varies from *nil* to full power, while that of an engine driving a rail mill changes from *nil* to practically full power while rolling a single rail twelve times, which requires about one minute.

Let us for a moment think of a fly-wheel 26 feet in diameter, 16-inch rim, making from 70 to 80 revolutions per minute, rolling a steel bloom into a rail. When about one-half done, say, about 16 feet in length, instead of the piece going straight out through the rolls on the guides, as intended, it sometimes wedges in the groove, and in less than a second of time it has completely encircled the roll, and forms what in rolling-mill phrase is called a collar, and continues to wind around the roll until something must happen, either the breaking of a roll, a spindle, or coupling, or the engine must be brought to a standstill in an almost incredibly short space of time. The torsion on the spindles and couplings is so great that it causes the wheel to rebound. To calculate the strain the wheel is subjected to under these conditions will require someone better posted in mathematics than I am.

Having alluded to the fact that the introduction of steel in various forms required larger rolls, heavier wheels and larger in diameter, which made it impracticable to use a solid-rimmed wheel, and led to the adoption of plan of wheel, Fig. 6; this drawing makes it so plain that it wants but little explanation. The segment is cast hollow, and also the arms, which are made at the ends to compare in thickness to the segment, so as to relieve them of strains which might occur if the segments were cast solid. The holes in the segments are small at the ends, so as to make up for the metal taken out for

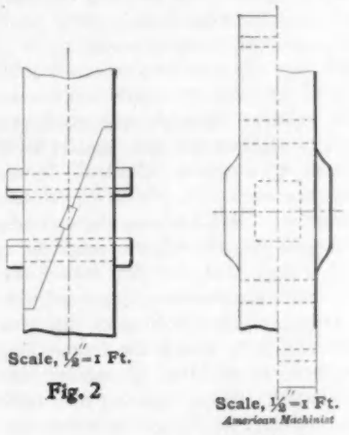


Fig. 2 Fig. 1

RIM JOINTS.

the tees. The links, or tees, are of different lengths, so that the strain on the segments will not come all at one place, and by using oil-tempered steel in the links, or double tees, the rim will be practically as strong at the joints as it is elsewhere.

In fitting up the wheel, the center is bored out, and the ends of the hub are faced off. It then is taken to the planer, and a center-guide plate for the hub is made, and bolted to the planer table. Then a boring bar is arranged to bore out the hole and face it off to a given distance from the center for the shoulder of the arm to rest on. There are small chipping pieces on both inner sides of the receptacle for the arm. They are planed off at the same setting, to the proper and uniform

* Presented at the Washington meeting of the American Society of Mechanical Engineers.

width and true to the center. This finishes the center.

Next the arm goes on the planer and is set true to the average center, and with a at this setting the chipping piece on the upper side of arm, as it lies on the planer, corresponding with the same in the center, is planed off, and the average center of other side up, and a socket is made to fit over the end of the arm which goes into the socket and against the shoulder. On the opposite end of the socket is a hole

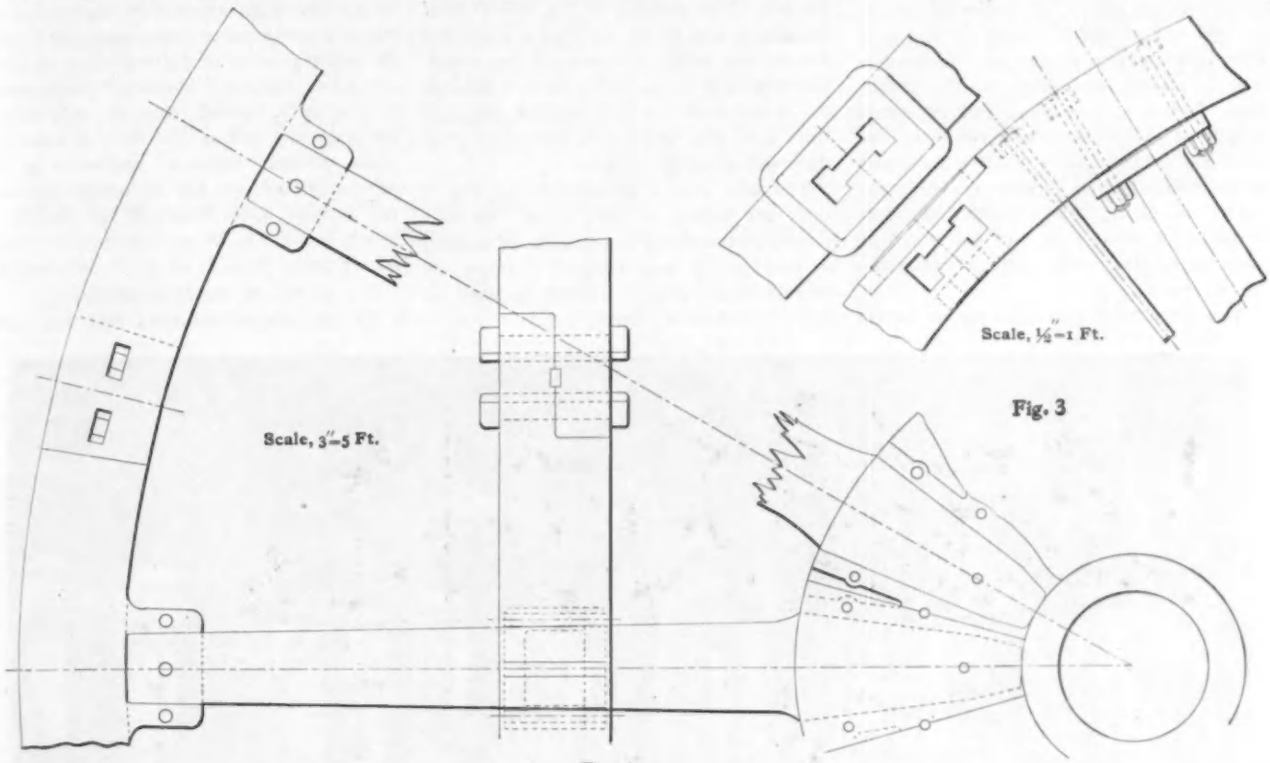


Fig. 4

Fig. 3

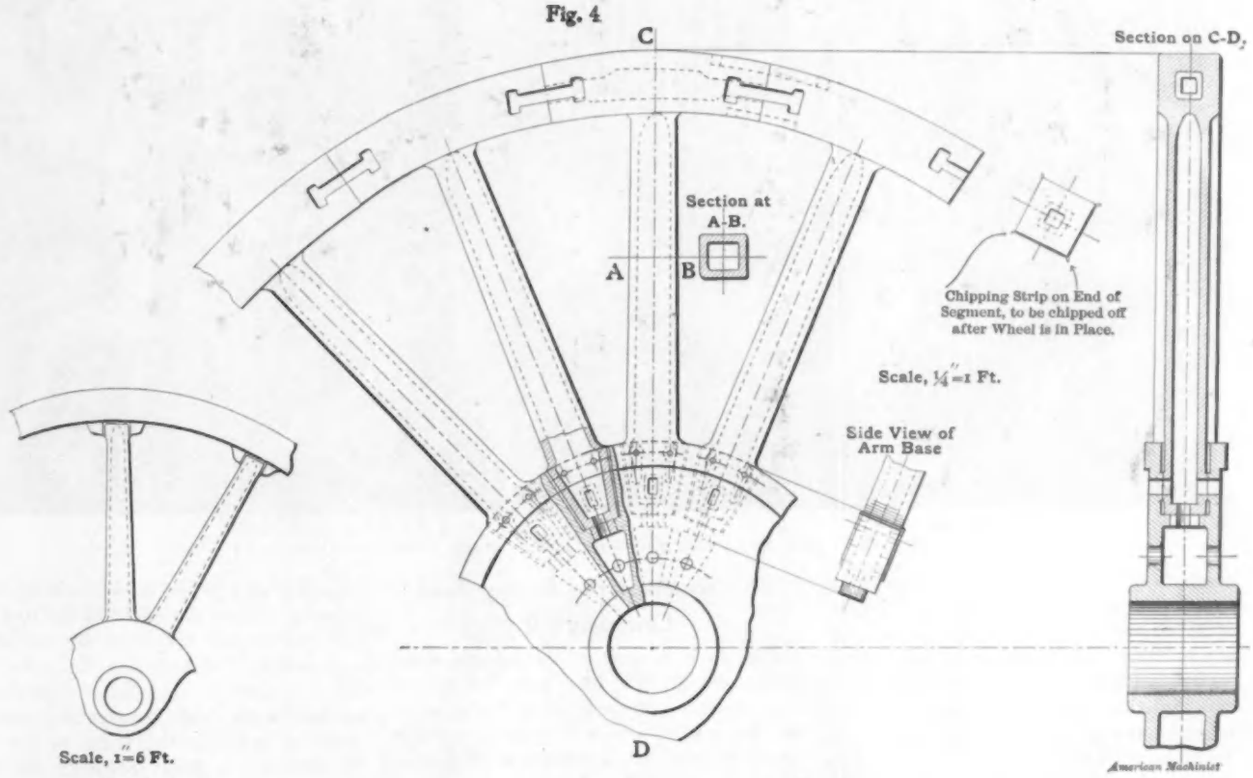


Fig. 5 Fig. 6

ROLLING-MILL FLY-WHEELS.

socket on the end of the boring bar with inside cutters the end of the arm is turned off, and the shoulder is faced off to the proper length for the arm to rest on; also the segment is also carefully taken and correctly worked.

After the arms are thus far finished, they are placed on the planer again, the bored, say, 1½ or 2 inches in diameter. The length of arm must be, from the center of the hole to the bottom of the socket which the arm rests on, the same as the

distance from the face upon which the arm rests to the center of the hole in the shaft.

Next secure a pin on the planer bed to correspond in size with the hole in the end of socket piece. Then put the socket on the end of the arm and on the pin; then bolt the arm down true on the side that is planed, and finish to the proper size. When this is done, find the exact length of the segment and set it in line with the center, and you have the exact angle, and when all is done correctly the wheel will fit together without a chisel or a file being used on it, and will run true without turning, minus the irregularities in the castings.

You will notice that there are no abrupt changes in the thickness of the castings, thus avoiding as much as possible the liability of strains. The joints in the segments are generally the weak part of the wheel. In this respect a wheel made from this drawing will be stronger than the original, as the tees in the segments in the wheel now in use were made of wrought iron, and will probably not stand over 50,000 pounds tensile per square inch, while in this wheel, if I was to build another, I would use steel that would stand at least 85,000 pounds tensile. This would make the joints practically as strong as the segments.

It will be noticed that there is a space in the center of about ¼ inch in the front and the rear side of each arm. This is filled with oakum and driven hard, after the wheel is finished and in place, to keep the arm from yielding in the direction of the strain, and at the same time it greatly lessens the work of fitting up the wheel. The 1¾-inch round holes shown through the center and arm, are reamed out, and steel pins are made and turned so that they will drive in snugly.

The bolt shown in segment in Fig. 3 does not belong to this wheel, but was simply put in there to show the plan that, in many cases, was adopted to make the wheels more secure, and it is used to some extent at this time.

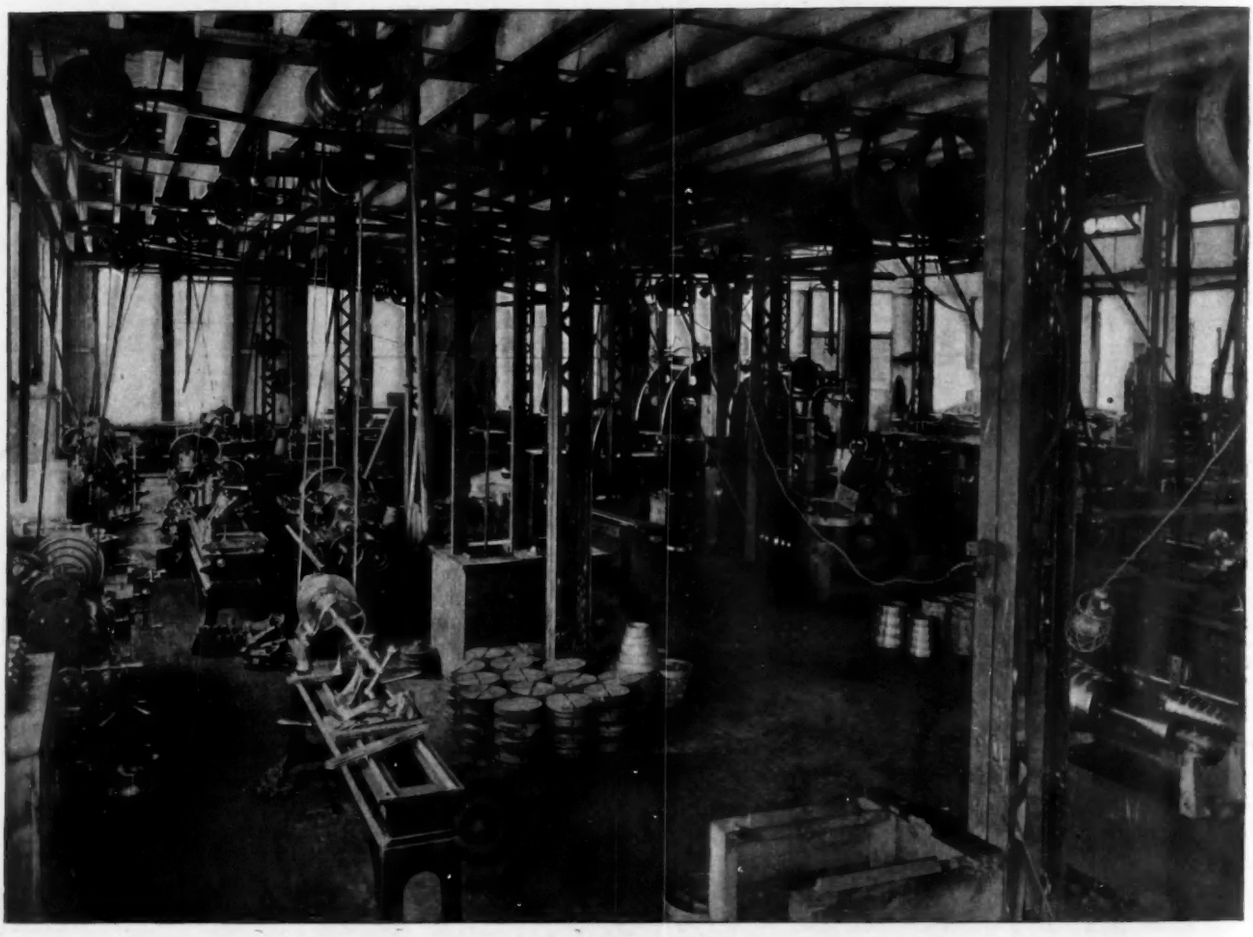


FIG. 22. VIEW OF LANDIS SHOPS ON LOWER FLOOR UNDER GALLERY.

The Shops of the Landis Tool Company—II.

Fig. 22 is a view of the Landis shops under the gallery floor and just behind the planers that were shown last week. In this region, which is devoted to lathe work, milling, etc., a great deal of interest is to be seen if the observer cares to see what the most modern shop practice is and what can be done in the way of taking cuts of a character that would not have been thought of a few years ago. In the first place, it may be worth while to notice the speed-lathe in the fore-ground, which shows that in respect of finishing work by filing, scraping or polishing, this shop follows a practice which, although it is as old as the hills and perfectly familiar to most of us, is yet by no means universal; very many shops where they ought to have learned better many years ago continuing the older practice of putting all work into an engine lathe and keeping it there until it is entirely finished; thus not only using for a good share of the work a machine three or four times as expensive as is necessary, but one not so convenient for the purpose, aside from the fact that it is much better for an engine lathe to keep emery away from it as much as possible.

A PULLEY TURNING FIXTURE.

Every lathesman knows that for each job done in a given lathe there is somewhere a limit to the width of the tool that can be fed into the work by the cross-feed screw. Beyond this limit the tool chatters, there is more noise than accomplished work, and greater headway is made by reducing the width of the tool. If, however, a pulley 8 inches diameter, 3½-inch face and having four arms is to be turned off, we recognize that the limiting factor in such a case is the pulley itself; its rim not being of sufficient thickness to resist the tendency to chatter where tools of any considerable width are applied to it. The old standard way of

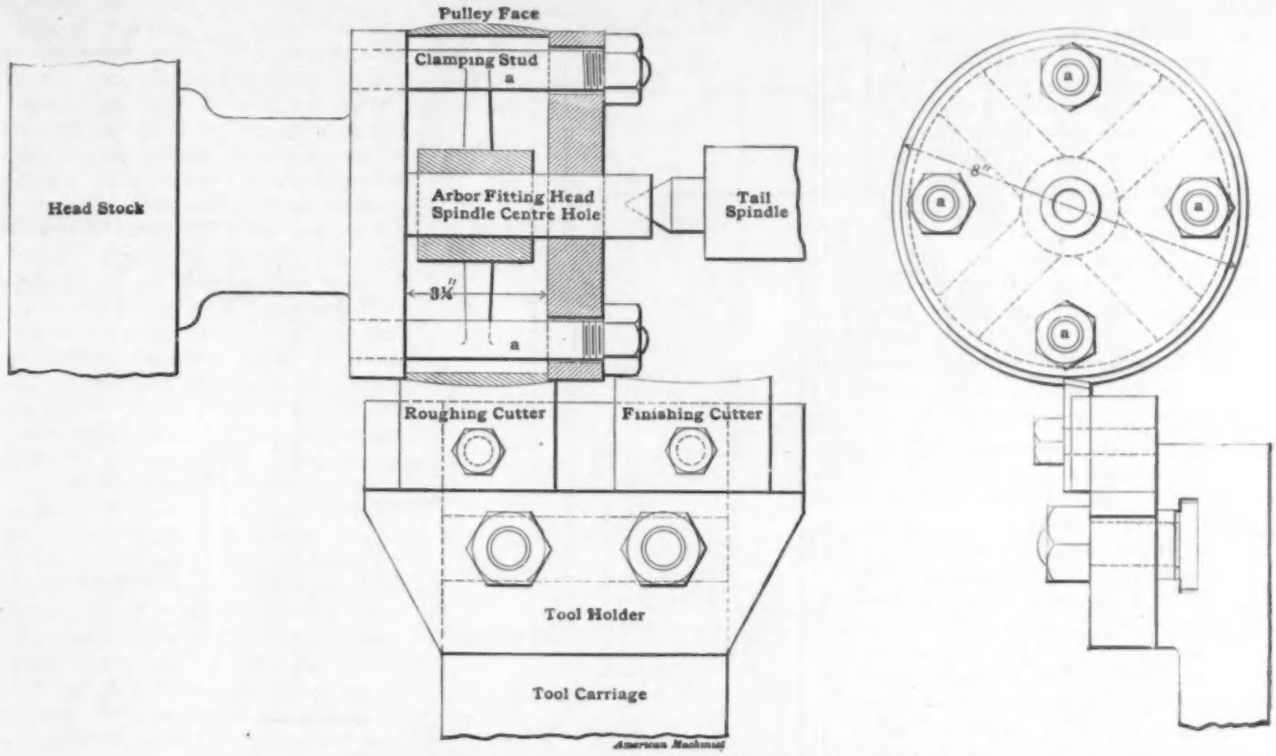


FIG. 23. FIXTURE FOR TURNING PULLEY RIMS IN LANDIS SHOPS.

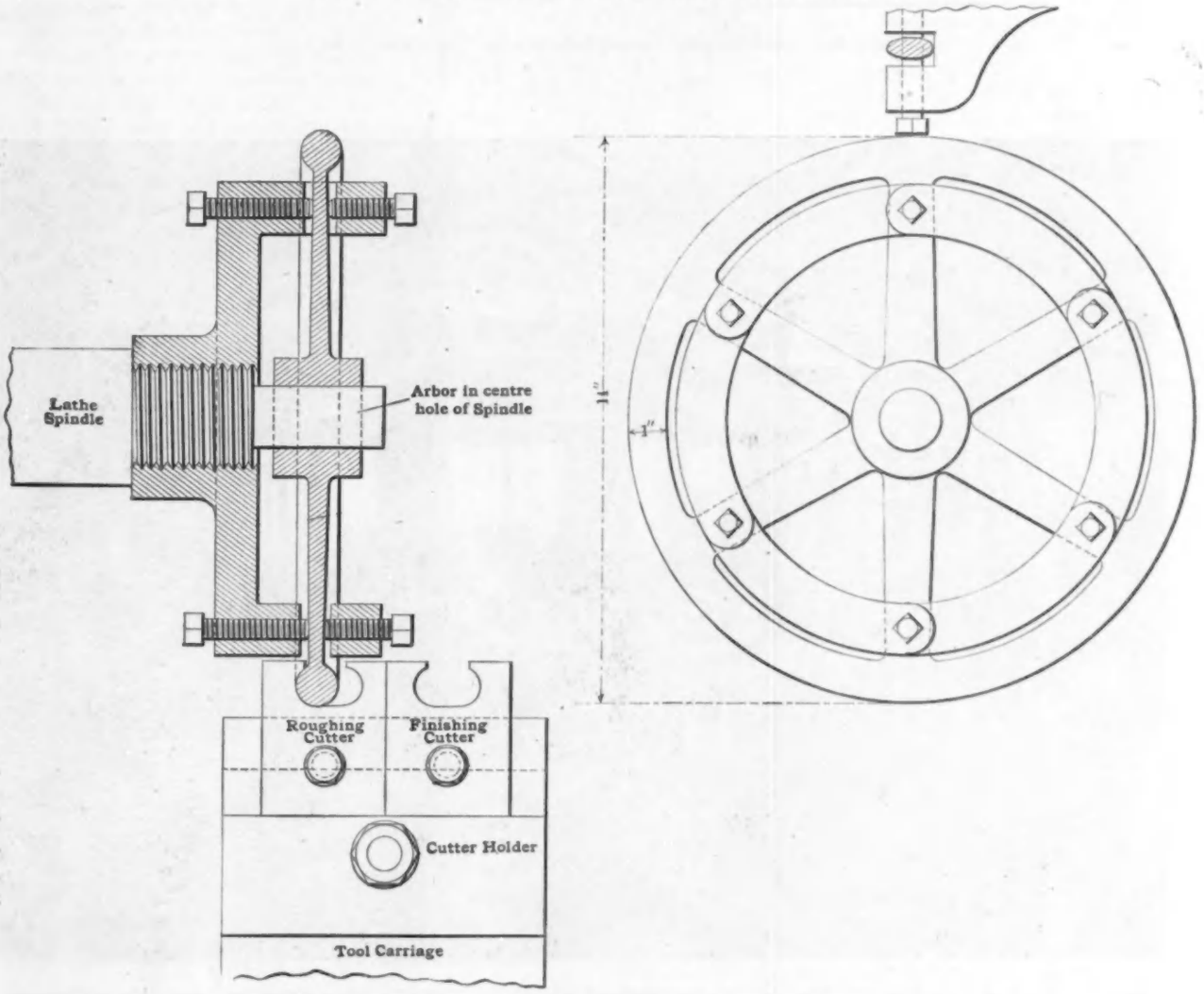


FIG. 24. HAND-WHEEL RIM-TURNING TOOL AND CHUCK MADE AND USED IN SHOPS OF LANDIS TOOL COMPANY.

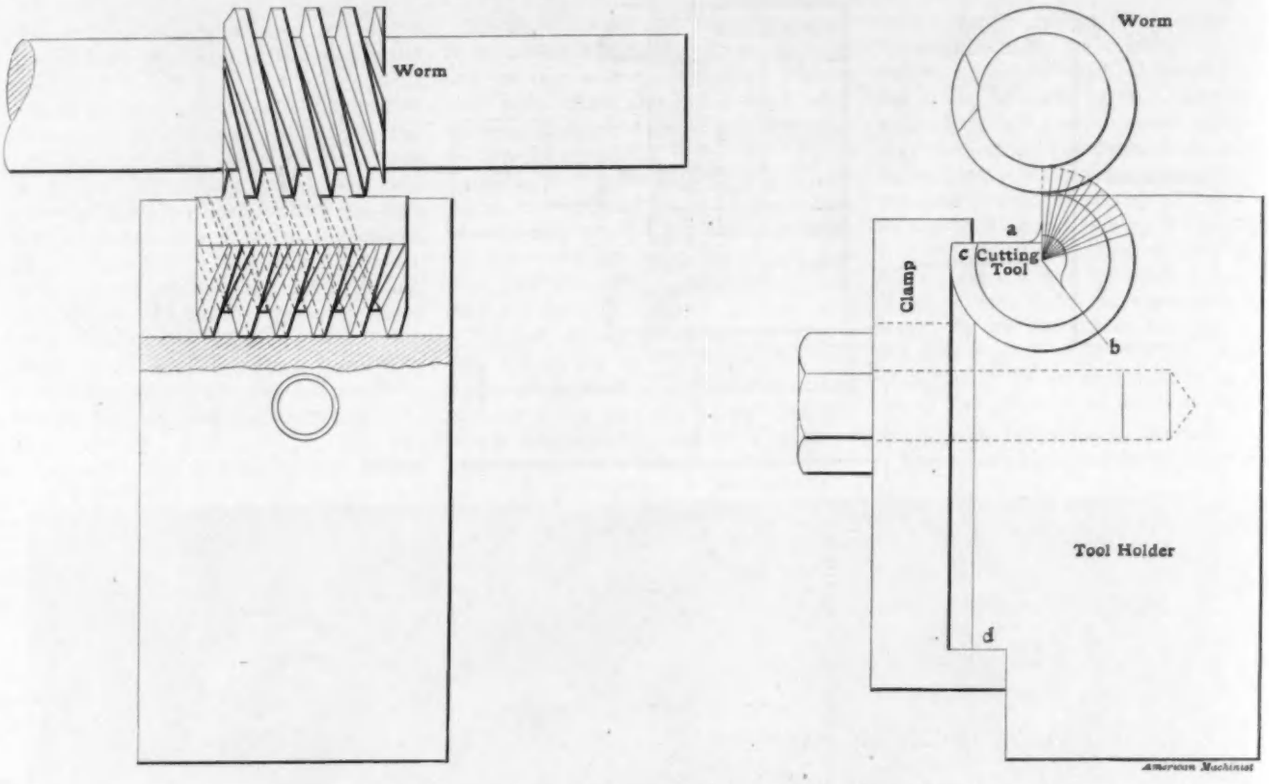


FIG. 25. TRIPLE-THREAD WORM-CUTTING TOOL. LANDIS TOOL COMPANY.

FIG. 26. VIEW ON UPPER OR GALLERY FLOOR, SHOPS OF LANDIS TOOL COMPANY.

dealing with such a case is familiar, and although where many pulleys are finished this has been improved upon by the use of special machines designed for pulleys, the older method is still in use generally where no great amount of such work is to be done. In the Landis shops, however, although the work is done in an ordinary engine lathe fitted with a few inexpensive fixtures, the work is well done at a rate which, so far as I know, is not equalled even by any special pulley machine. The pulley is first bored and reamed in a turret chucking machine, and at the same time one edge of the rim is faced true with the bore. The pulley is then placed on an arbor and the other edge of the rim faced. It is then put into the fixture shown in Fig. 23, which explains itself and shows that the rim is firmly clamped so that no springing can occur in it. To increase the gripping power the clamping studs are made with threads finer than the standard, so that the rim can be very firmly and securely held. First a roughing and then a finishing cutter are applied to the rim, these cutters being thoroughly well supported, as shown, and shaped so as to give the proper crown to the rim. After the roughing cutter has been used, and before the finishing cutter is applied, the clamping nuts are all loosened to allow the pulley rim to take its natural form, and are then tightened again for the finishing cut. The pulley shown, which is used upon a counter-shaft, is of the size given in the drawing, and the best time so far made in turning the rim of such a pulley by this method is five minutes. These pulleys, and indeed all the castings used in the Landis shops, are thoroughly pickled to remove sand and scale before they go to the machine shop, and it is believed that this practice pays a very large return in facilitating the work upon them and in adding to the life of the tools. The fixtures shown are not expensive, and the results of their use are remarkable.

A HAND-WHEEL TURNING FIXTURE.

An operation of a similar nature is performed upon the round rims of the hand wheels used upon the Landis grinders, and the arrangement for doing this is made plain in Fig. 24, where it is seen that the wheel which has been previously bored and reamed, is placed upon a short stud arbor fitted to the lathe spindle, rotated upon this arbor to bring its arms between the various pairs of set-screws provided, and these adjusted so as to avoid springing the wheel. These set screws do not drive, however, that being done by the chuck itself, as indicated at the upper right-hand corner of the drawing. The tool is first run on to the rim until it is reduced to the proper diameter and then is moved laterally until the rim is cleaned up and reduced to the right thickness, as shown by a caliper, the roughing and finishing tools being used in succession as before. At first it was Mr. Landis' intention to have the opening in the cutter just the right width, so that when it passed over the sides of the rim the latter would be made the right thickness and there would then be nothing for the tool to do by the carriage movement except to round up the rim. The necessity for sharpening the two points of the tool made them soon lose their size, however, and this plan was given up for the method by calipering. Twelve of these wheels, 14 inches diameter and with 1-inch rims, have been thus turned ready for polishing in one hour.

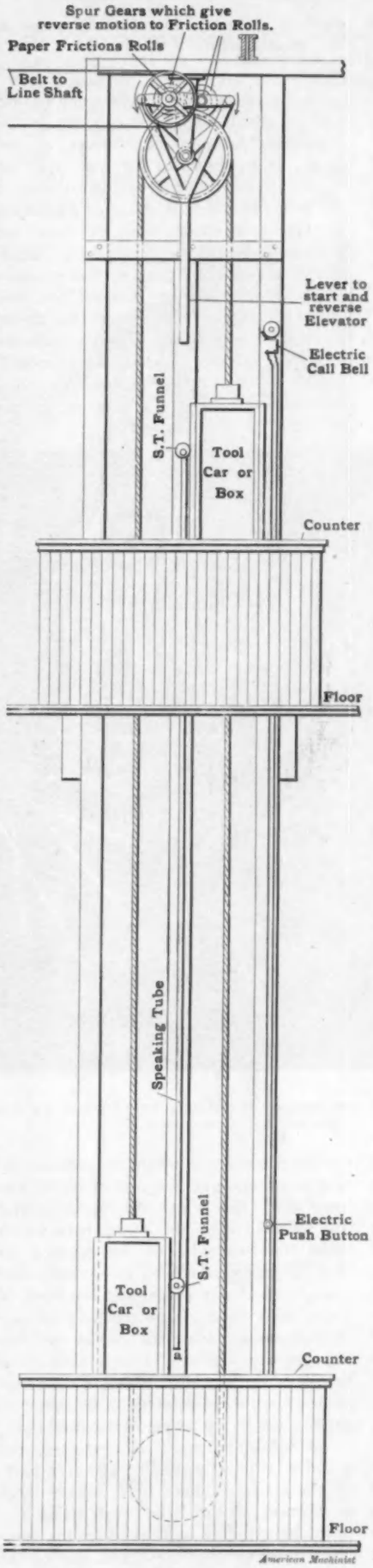


FIG. 27. ELEVATOR TO TOOL-ROOM.

CHASING TRIPLE-THREADED WORMS.

A good many triple-threaded worms are cut in this shop, and I happened to see a man cutting them with the fixture shown in Fig. 25. The cutting tool in this case is a section of a left-hand screw, which is the same diameter and otherwise just the same as the right-hand worm which is to be cut. It is made of a fine quality of tool steel; a gap milled out of it, as shown, to give a cutting edge, and when in use held in cylindrical seat formed in a block attached to the lathe tool rest. Being left-handed it has just the right angle to clear the threads being cut, and it can be sharpened by grinding without change of form so long as the ground surface is kept radial. As the cutter is ground the edge *c* will recede, and the clamp must go back with it, and when this is done a wedge is slipped in between the clamp and the block at *d* to prevent the clamp being drawn forward by the tendency of the cut to rotate the cutter in its seat. All but three of the cutting edges are ground away sufficiently to clear the work, but are left around the rest of the circumference to give the cutter the best possible support. By the use of this cutter much time is saved in grinding tools. The three threads are cut simultaneously and there is none of the bother of turning the work upon the centers or of shifting the change gears to divide the threads properly that attends the process of cutting in the old way by a single tool.

A TOOL-ROOM ELEVATOR.

There are many other interesting and instructive examples of the most modern machine shop practice to be seen in this corner, but it is impracticable to show them all at this time. One of the most interesting things, perhaps, although of an entirely different nature from those described, is to be seen about the center of the photograph, Fig. 22, and is the lower portion of the previously referred to elevator, by which tools and supplies are carried up and down between this ground floor and the tool room, which is on the gallery floor above. The upper portion of the same elevator is seen through the wire netting surrounding the tool room at the left of Fig. 26, and a drawing of the complete thing appears in Fig. 27. There are

two similar carriages which are attached to the opposite ends of the same rope, so that when one goes up the other goes down. This rope passes over a pulley which has a groove in the middle of its face to receive it. This pulley is, however, considerably wider than is necessary for the rope alone, for it is also a plain friction pulley and adapted to be driven in either direction by one or the other of two paper-covered friction rolls which are geared together and driven by the pulley and belt shown, and are mounted in a swinging frame in such a manner that the tool-room boy can, by moving the vertical lever seen in front, bring either roll into contact with the pulley, and thus give motion to the cages in either direction. An electric call bell is provided and also a speaking tube, as shown. It will be noticed that the rope is practically endless and that it is carried over a pulley at the bottom, which not only affords a means of obtaining any needed amount of tension on the rope, but prevents one of the carriages being run up when for any accidental reason the other may be prevented from moving. The counter at the bottom provides the positive stop for both carriages when moving in either direction. This elevator is precisely like one that was built by Mr. Landis in the shops of the Geiser Manufacturing Company when he worked there fifteen years ago, and which is still in use and has never given any trouble in any way. The lever by its own weight returns to the position shown in Fig. 27 when released, and the elevator therefore automatically stops itself at any point.

A TRANSFER TRUCK.

At Fig. 28 is a go-cart designed by Mr. Landis, which may be called one of the important labor-saving devices of the shop. It is horseless, but that is by no means its chief virtue, which consists in the fact that it can be run over a grinding machine as it stands upon the floor, and by manipulating the hooks and hand-wheels above it will pick up this grinding machine and support it upon the two truck-wheels, so that it can be moved about to any required position with the minimum of muscular effort and expenditure of time. The photograph shows the truck with a No. 3 grinder on its way to the warehouse, where it receives its final inspection and last coat of paint. The cross-bars from which the hooks depend are movable upon the round bars which unite the two sides of the machine so that they may be moved to accommodate a machine of any width, and the hook in front takes hold of the machine by two door openings, while the one at the rear engages with one hole at the center of the length of the machine, which is thus supported upon three points with its center of gravity below the axles of the cart.

As would naturally be expected, the grinder is liberally used in finishing parts of the machines made here, a very large proportion of the lathe work being finished by grinding instead of by the common finishing processes; and one of the most interesting sights of the place is the collection of drawers or trays which Mr. Landis pulls out one after the other for your inspection, so that you see the large stock of parts that have been thus finished to limit gages, oiled and laid away until needed by the erectors. Not only because the pieces are in themselves beautifully finished, but because also of what they represent to him who knows the difference between file-and-emery-cloth-finished work made a few pieces at a time, each fitted to its particular place, and large numbers of pieces made all at once and ground on dead centers true and to gages, with the knowledge that they will fit in places yet to be made for them by means of other gages, they are, to a mechanic, beautiful.

F. J. M.

FIG. 28. CART FOR MOVING MACHINES IN SHOPS OF LANDIS TOOL COMPANY.

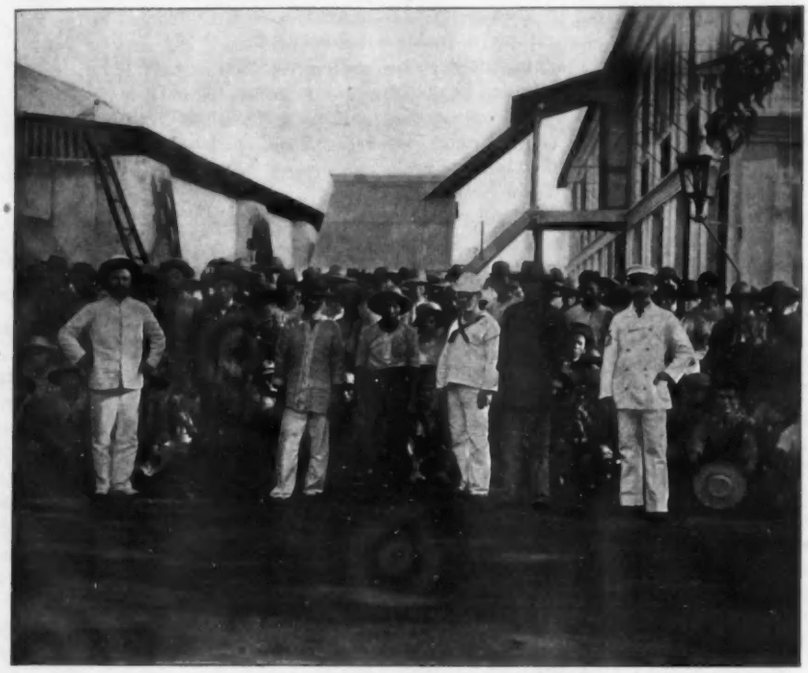
Some time ago we spoke of the alliance between the proprietors of metal bedstead factories in Birmingham, England, and of the fact that employees were included and co-operated with their employers in maintaining that alliance. A Birmingham paper just at hand seems to think this alliance has carried things on a little too high handed, and says this has resulted in London buyers moving for the erection of a plant in Belgium, where it is expected that cheaper bedsteads can be made for the English market. If such a move is successful, it will of course compel the Birmingham manufacturers to make competing terms, but they will be much better able to do so with the active co-operation of their workmen than they would be without it, and can much more easily improve their methods of manufacture.

A Picture From Cavité.

We give on this page a reproduction of a photograph taken in the yard of the arsenal at Cavité. Since its capture by the American naval forces a year ago it has been used as a naval repair station, and Gustave Kaemmerling, who is one of the engineer officers of the flagship Olympia, is in charge of it, and sends us the photograph.

Only a small part of the force is seen in the picture, there being at the time it was taken 350 men on the rolls. When the rupture between the Americans and the Filipinos took place Mr. Kaemmerling writes that the insurgents took with them most of the workmen, and Chinamen had to be taken on in their places, which caused much bother in getting re-organized.

Mr. Kaemmerling stands at the left of the picture. In front and next to him is a fireman, who is Mr. Kaemmerling's interpreter. One of the regular machinists of the fleet is also standing in front, and at the right another officer. The other men in the front line are Filipino foremen.



MR. GUSTAVE KAEMMERLING, PASSED ASSISTANT ENGINEER, U. S. N., AND SOME OF HIS FORCE AT THE NAVAL REPAIR STATION, CAVITE.

Drawing Rectangular Shells.

BY GEO. B. PAINTER.

The method of constructing a "double-action" punch and die, described in this article, for drawing oval and square work, has several good features.

Figs. 1, 2, and 3 show the die bed *E*, planed from front to back for the lower or drawing die *D*, and from right to left for the upper or blanking die *C*. The dies are both planed to an angle of 10 degrees from the vertical, and keyed into place. This arrangement allows the dies to be made of separate pieces easily worked, admits of grinding the faces of both dies after hardening, the removal for repairs of either one of the dies without disturbing the other, and also gives a means of adjustment between the two dies, in the relation of the drawing edge to the cutting edge, that is not as easily attainable in any other manner. The blank holder and blanking punch *B* is screwed and dowelled to the plate *A* in the usual manner.

Figs. 4, 5 and 6 show in outline the successive operations, eight in all, which were necessary to draw a rectangular shell 1¾ inches by 9-16 inch to finish 1¼ inches in depth. The finished shell is shown in the half-tone, Fig. 7. The specification called for a shell of the above dimensions, to be made of sheet copper, the corners to be full and sharp; at the bottom a radius of 1-32 inch was allowable. The shell was to gage No. 26 B. & S., .0159 after finishing.

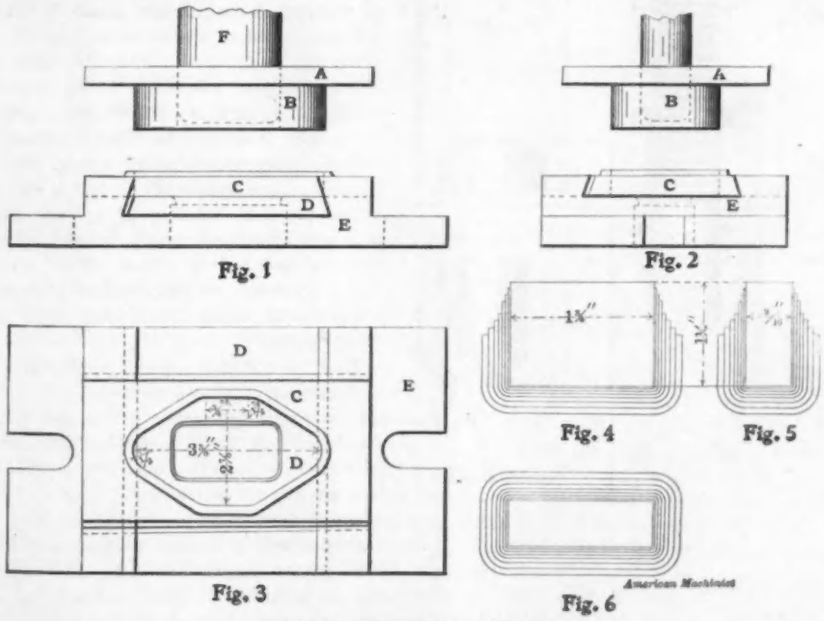
Fig. 3 is a plan of the blanking and drawing die for the first operation, and gives the outline and dimensions of the blank. The subsequent operations were performed in dies similar in all respects (except as to shape) to the dies used in re-drawing ordinary round work.

THE SHELL.

The following table gives the dimensions of the drawing dies and shows the reduction by operations. The data may be of value to some of my die-making friends, if they should happen to have a job of the same nature.

1st	operation from blank,	2 375	x 1.1875 in.,	Radii	.3125
2d	"	2 250	x 1.0625 in.,	"	.250
3d	"	2.125	x .9175 in.,	"	.1875
4th	"	2 0625	x .875 in.,	"	.150
5th	"	1.9375	x .750 in.,	"	.0945
6th	"	1.875	x .687 in.,	"	.0625
7th	"	1.812	x .625 in.,	"	.0315
8th	"	1.750	x .562 in.,	"	none

The metal used was No. 24 B. & S. gage .020, and was reduced two gages in passing through the various operations. An annealing was necessary after each drawing except the seventh, the last drawing being done without annealing to give the



DRAWING RECTANGULAR SHELLS.

shell a proper temper. The trimming of the shells was done with a metal sawing machine. In this trimming the shell was confined in a steel clamp, a fine toothed saw at high speed being used, thus giving a clean finish. While the drawing of shallow oblong and oval shapes in sheet metal is common, I think that the article described, together with the construction of the die for the first operation will be of interest.

A Large Award for the Use of a Valuable Invention.

About 1868 William A. Brickill, a foreman in the New York City Fire Department, perfected an apparatus, which the Fire Commissioners subsequently adopted, by means of which water could be kept hot in the boilers of steam fire engines when standing in the houses, and a pressure of 15 or 20 pounds of steam maintained without a fire in the boiler. The apparatus, now commonly used, or some equivalent device, in all the large cities, consists of a coil of pipe separate from the engine, but connected to it in the house and automatically detachable, the coil being heated by coal or gas or other means. With this apparatus in use an engine can respond to an alarm without starting a fire until it has been ascertained whether the alarm is a false one or not.

In 1870 Brickill offered to settle with the city for $50,000. Since then, he, with the other owners of the patent, instituted a suit, and the report of a special master is just published awarding to the complainants the sum of $894,633, of which $194,716 is interest. Between August, 1868, and August, 1885 (the life of the seventeen-year patent) 210 of the heaters were used without the plaintiffs' permission, and the award is the "amount of gains, profits, savings and advantages which have accrued from such unlawful use." The basis of the award was an estimated saving of 40 cents on each engine for each alarm.

A New "Power Economizer."

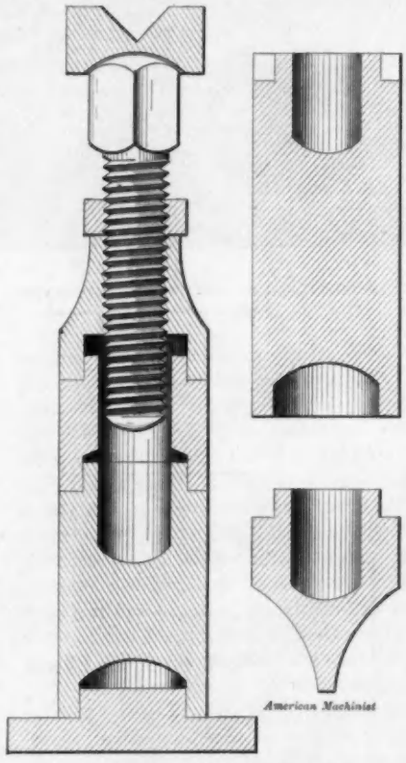
What is called a "Multiple Energizer Power Economizer" is said to have been recently completed in Philadelphia, $90,000 having been spent in its construction and in experiments in connection with it. The apparatus has four fly-wheels, each of which is driven by a small engine which may be connected to and disconnected from it alternately, each of the four operating successively. The engine is used only to get the fly-wheel up to a predetermined speed of, say, 190 rotations per minute; it is disconnected and the fly-wheel is clutched to the shaft which is to be driven, and to which it imparts a portion of its force, its speed, of course, being proportionately reduced. As the speed of the fly-wheel begins perceptibly to slacken it is unclutched and the second wheel is clutched to the shaft, when it also gives some impulse to the shaft, and so on successively.

The explanation offered, if not concocted by a simpleton, is certainly intended for simpletons. It is as follows:

"The working fly-wheel drops its burden at the end of half a second, and the little 5 horse-power engine has a second and a half in which to impart to the wheel, which is then running unrestrainedly on the shaft, sufficient momentum to enable it to take up its work again, after each one of the other wheels has gone through the same process. It will be seen by this that all the diminutive steam engine is called upon to do is to whirl the fly-wheel it faces to a speed of 190 revolutions, rest half a second while the wheel takes hold, to allow the momentum in the rim of the wheel to keep the machinery flying, and then get down to work again the instant the automatic clutch releases the fly-wheel. By means of this amazing device the engine never works directly upon the load, as all the burden it is required to carry is the fly-wheel." A practical engineer with indicators on the steam cylinders and a Prony brake on the driven shaft would very quickly knock the life out of this nonsense. It is not at all likely that more than ten horse-power would be shown at the shaft for the work of the four "diminutive" five-horse engines.

An Improved Jack Screw.

Any machinist who has done much setting of work on the planer, shaper, milling machine, boring mill, drill or elsewhere will readily understand and appreciate the combination, adaptable jack-screw shown in the cut. Every piece, ten in all, of the set is of tool steel, machined all over and hardened. It takes the place of blocking, is adjustable to any hight or length within its range, which is from about 1½ to 7 inches. The pieces are, as will be seen, all interchangeable, and by using one or more or all of the extension pieces in combination the entire range of hights is covered. Instead of the flat base, the wedge-shaped end may be used, and is preferable for setting at an angle. A shorter screw also is furnished, to be used with or without the jam-nut in close quarters. These jack-screws are made by the Waterbury Tool Company, Waterbury, Conn.



AN IMPROVED JACK SCREW.

The Work of the Small Shops—A Screw-Cutting Rig for the Shaper.

We have had recently in our columns some discussion of the chances of the small shops, and some rather discouraging views have been offered as to their future. It is a fact, however, that there is still a place for a great number of what may be called small shops, not only for repairing and renewing machinery, but also for experimenting and model making, and for the designing and construction of novel machinery of various kinds. Few persons have any idea of the demands of the various established businesses, in all lines of manufacture, and more especially of the new businesses which are constantly arising, for new and unheard of machines, and especially for machines that are completely automatic. Of the machine shops which live upon this demand, and which, if they live, also inevitably grow, there are several within our knowledge, and they are to be found in every large city, and often also in remote rural quarters.

One of these shops, not now so small, which we occasionally have the pleasure of visiting, is that of Mr. Louis T. Weiss, 286-290 Graham street, Brooklyn, N. Y. Here are always new and usually intricate and ingenious machines being devised, and not only new machines for customers, but new contrivances are continually called for in the shop for doing what is wanted. Lately Mr. Weiss had a call for a considerable number of screws about 9-16 inch diameter, 2 or 3 inches long and with a pitch of 2 inches. The screws were, of course, to be of manifold thread, six threads being used, and with accurately fitting nuts.

Now, for doing jobs of this character the number of pieces to be made is often the determining factor as to the means employed. A single screw and nut could, of course, be worked out in a good lathe by an expert workman. For a large quantity, and with a constant demand for reproduction, a special machine might be devised for tapping the nuts, the machine for such work, of course, providing for the longitudinal thrust of the tap and its correct travel, as well as for its mere

rotation. So a special machine might have been made for milling the screws, with six cutters, cutting all the threads at once, or some other device might have been gotten up for the purpose. The number of pieces that the job called for, however, would not warrant such elaborate preparation as this, and accordingly the device shown in the accompanying sketches was made to be used on a shaper for cutting both the screws and the nuts. It was perfectly satisfactory for each operation, and cheaply did an excellent job without expensive supervision after once in full swing.

Fig. 1 is a longitudinal section of the device, and is a practical reproduction of the orginal shop drawing. Figs. 2 and 3 are end views of the same, the front and back ends being designated according to the location on the shaper table. There is one main casting with two large hubs united by a long flat piece, the bottom of which is planed for fastening to the table. On the drawing is a legend for the pattern maker, which might be more frequently written and followed in similar cases. The instructions are: "Make pattern *for one casting*," and we may well understand that the pattern maker did not waste much time in elaborately finishing the pattern like a piece of cabinet work, as some like to do.

What we may call the headstock end of the casting had a fine thread cut into each end of the hub, and in these ends were screwed steel rings with beveled faces, forming channels for ball bearings. A hardened steel sleeve *A* revolved in these ball bearings, the forward bearing giving only a lateral guidance to the sleeve, while the back bearing provided also for the longitudinal thrust in both directions. The outer threaded collars of the hub were adjustable, so that the balls could be made to move easily, yet without any lost motion. It was quite necessary to provide the easy rotation which the balls permitted, while it was quite as necessary to avoid any play between the sleeve and its bearing. On the forward end of the sleeve *A* was fastened a small face plate *E* with six notches upon its periphery, corresponding to the six threads to be cut. The spindle *B* was fitted internally to the sleeve *A*, being inserted from the front end and secured by the central screw and the overlapping washer *D*. When the washer was secured the spindle *B* was free to turn in *A*, but was held from turning by the latch *F*, carried by the clamping piece *H* on the extreme front end of *B*. This piece *H* was secured by a feather to the spindle *B*, so that they must always turn together, but at the end of *H*, opposite the latch, it was split, as was also the end of the spindle. The end of the screw *I* to be cut was inserted in the hole in the front end of the spindle *B* and securely fastened there by tightening the clamping screw in the split end of *H*.

At the back end of the sleeve *A* was fastened the steep pitch double-thread screw *C*. The end of the screw was driven into *A* to a shoulder and fastened by a taper cross-pin. The screw was double threaded and of the same pitch, 2 inches, as the screws to be cut. Moving easily on this screw, but fitting it accurately, was the nut *J*, fastened in the casting *K*, which was clamped to the slide of the shaper ram and moved back and forth with it. The reciprocating movement of the nut *J*, coincident with the movement of the cutting tool, produced the required rotation of the spindle *B* and the screw *I*. The tool was fed down to the required depth for cutting one space in the screw, then raised. The spindle *B* was turned in the sleeve *A* by moving the latch *F* to the next notch, when the next space of the screw was cut, and so on around until the screw was completed.

The end of the screw *I* was so securely clamped by the piece *H* that all the pull of the tool was taken by the headstock, and the only duty of the footstock therefore was to provide lateral guidance for the outer end of the screw *I*. A hole was drilled in the end of *I* and the pin end of the footstock spindle *L* was inserted. The footstock hub and bushing were split at the side, as shown, for the purpose of clamping the spindle *L*.

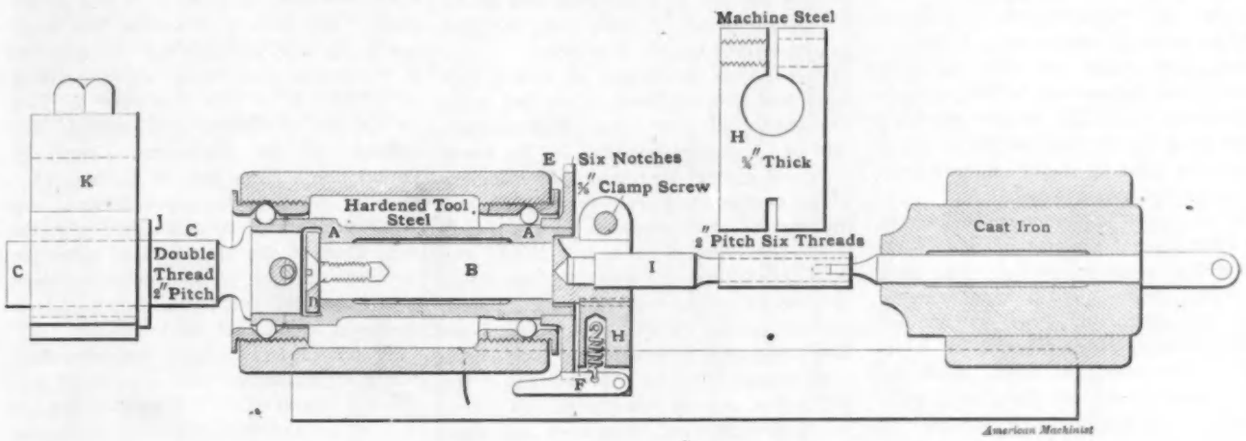


Fig. 1

RIG FOR CUTTING MULTIPLE THREAD SCREW IN SHAPER.

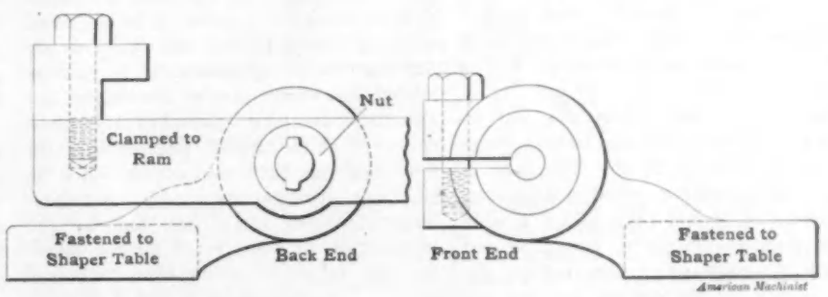


Fig. 2 **Fig. 3**

HEADSTOCK AND FOOTSTOCK OF MULTIPLE THREAD CUTTING RIG.

For cutting the nuts, which had a fine thread and a shoulder on the outside, the clamping piece *H* was removed and a chuck put on in its place, into which the nuts were screwed. The nut spaces were then cut one after the other by a hook tool reaching through the hole and cutting outwards or pulling the chip out of the hole. The screws were of steel, while the nuts were of brass.

A Decade of Progress in Reducing Costs.

The address with the above title, by Mr. Charles Kirchoff, editor of "The Iron Age," and president of the American Institute of Mining Engineers, at the February meeting in New York, was a suggestive and valuable one. We are able to present only a brief abstract embodying the most salient points.

"There is one cardinal feature which characterizes the engineer's work—namely, the permanence of his achievements. Every improvement, particularly when it has been recorded in such lasting form as a paper in the *Transactions* of our societies—every improvement represents an advance from which there is no receding. From time to time we have epoch-making discoveries which advance the art at a bound, but in the aggregate greater progress is made in the direction of reducing costs by minor improvements in practice and equipment."

The purpose of the paper was to present data indicating the extent of this movement within a limited period. The most convenient method would have been to follow the course of prices, but a comparison of costs strikes deeper, as it reveals the directions in which most has been accomplished, and along what lines further developments may be possible and profitable. Although the cost sheet is sacred to the producer, a number of firms furnished reports, showing in percentage of costs of a base year, how the outlays varied in a series of years. Statistics of this scope tell only a part of the story, because they must naturally be restricted to those operations and plants in which revolutionary changes in methods have not been introduced to defeat comparison. Figures bearing on cost of product also deal with the article manufactured with reference only to quantity, and do not show how the standard has been raised as to quality—both as to excellence and as to uniformity.

The first item treated is the cost of pig-iron, and the data are from a large furnace plant in the South. The basis is the year 1889, and the period is from then until the end of last year. Both a table and a diagram are given, embracing ten particulars, each of which, except the first, which is the average product per day, shows a very marked decrease for the period, but with most erratic fluctuations. The cost in each case for 1889 being 100, the costs or other particulars for last year were as follows: Coke consumption per ton of iron, 91.2; ore cost, 79; limestone cost, 40.3; coke cost, 64.1; labor cost, 51.9; cost of sundries, 33.4; total cost, 63.4; average selling price, 61.2; net average profit, 47.9. In 1893 there was no profit, and every item shows a pronounced change from that year.

Data are then given of an Eastern plant for the corresponding period with similar general results, but with somewhat less range of fluctuation. In a Pittsburgh plant for a period of ten years the final percentage of labor cost, as compared with ten years before, was 46, and for total cost, exclusive of raw materials, it was 44.

In the cost of producing Bessemer steel ingots the fluctuations are first sharply downward to 1894, little change to 1895, up again to 1896 and then more gently downward. The cost of molds per ton took a steep tumble from 1897 to 1898, suggesting some pronounced improvement in practice.

The cost of conversion of Bessemer ingots in one mill in Pittsburgh was nearly cut in two in eleven years, being for 1897 52 per cent. of the cost for 1887.

Probably in no branch of rolling mill work has progress been so marked as in the making of wire rods. William Garrett, of Cleveland, furnishes for the paper a record of the progressive development of the output for twenty-four hours, and the cost of the conversion of the 4-inch billets into the wire rods. While the daily production has steadily increased, the cost of rolling has steadily decreased, the former in eleven years going from 100 to 325, and the latter from 100 to 63.6.

Numerous items of improvement in the details of mining operations are cited, with accompanying reductions of costs. By concentrating the operations a reduced cost for haulage and maintenance of tracks is effected. There have been improvements in mechanical haulage appliances, like pneumatic haulage, the endless-rope system, and the tail-rope system, and these, with the improvements of mine tracks by better grading, heavier rails, etc., have resulted in increased loads, higher speeds and larger output at reduced cost for hauling, which has more than compensated for the increased length of haul due to the retreating of the mine workings from the pit mouth. Gravity has been taken advantage of in hauling loaded and empty cars at the shafts, and automatic dumping appliances have been employed at the tipple. Improvements in mine drainage have been accomplished by judicious concentration, by installing larger pumping appliances, and by the substitution of compressed air for steam for draining points remote from the power plant. The substitution of steam locomotives and endless gravity rope appliances for mule power for conveying the coal from the bins to the ovens, and for charging the latter, have contributed to the general economy, and the output of the coke ovens has been increased by increasing their size and by more carefully and scientifically operating them. From 1887 to 1897, while the cost of coke fell from 100 to 87.3, the labor earnings increased from 100 to 112.5.

In lead smelting, from 1887 to 1897, the money cost of lead ore smelted and refined has gone from 100 to 65, and the fuel consumption from 100 to 71.2. A great gain has also resulted from the ability to smelt charges lower in lead. Where 10 per cent. was, previous to 1890, considered the minimum for profit, charges as low as 6 per cent. are now used.

The paper concludes as follows:

"These examples, I believe, illustrate how rapidly, in every branch, costs have been reduced during the past decade, and they naturally lead to the question whether we may hope to continue such a rate of progress. The first impulse is to reply in the negative, since it is admittedly more difficult to effect reductions after they have once cut down costs to a certain point. Speculation is useless, but hopes are being held out that may be closer to a realization than many may be willing to admit. It is only necessary to point to the use of electric appliances in coal mining, to the introduction into this country on a large scale of European by-product ovens, to the rapid developments lately of the slag cement industry, to the utilization of the blast-furnace gases for power production, to the continuous open-hearth process, and to the latest achievements in rolling-mill work.

"Technical knowledge is becoming more and more a common possession of all producing countries. The race is one in which one and then the other contestant is in the lead. The strain of competition is becoming more and more severe. That under such circumstances the mining engineer will not in the future crowd the records of the past it is difficult to believe."

A New Steam Engine Indicator.

The accompanying sectional views show a new indicator which has just been placed on the market by the Engineering & Power Company, of 171 Broadway, New York. It is from designs by Mr. A. C. Lippincott, who is well known in connection with this class of work.

The instrument embodies some new features, chief of which is a self-adjusting piston which is intended to obviate any tendency on the part of the spring to produce side thrust on the piston. This feature is best shown by the enlarged view of the piston, shown below and to the right of the main view, Fig. 1. From this it will be seen that the piston is at liberty to adjust itself sidewise in order to free itself from such pressure. Another feature will be seen in the extension of the piston rod and the provision of a guide below the piston which assists in guiding the spring in a straight line. Mr. Lippincott believes in a piston which is a free fit in the cylinder, and he makes his pistons in this way. He states that no reasonable amount of leakage in the piston will produce any appreciable effect on the records of the instrument, provided free escape for the steam above the piston is

provided. Such escape through the usual holes in the cylinder barrel would be a source of annoyance, and to prevent this the paper drum arm is made hollow for a portion of its length, a swiveling nozzle being fitted below the arm and communicating with it. In use this nozzle is turned to discharge its steam away from the operator, and thus all annoyance from this source is avoided.

Mr. Lippincott also finds the customary practice of using the port bore below the main cylinder in connection with a piston of reduced diameter for high-pressure work to be objectionable, because in the ordinary use of the instrument with the large piston this port soon becomes rough and pitted from the action of the steam.

To meet this he furnishes as a regular part of the outfit a supplementary cylinder and piston fitted as shown in Fig. 2. This may be inserted as needed, and of course furnishes a cylinder surface which is always in good condition.

The effect of the free piston is said to be very marked. Mr. Lippincott claims that a test card taken under a mercury column shows a complete absence of lag in the movement, the lines for the same pressure, when ascending and descending the scale, being coincident. This lag has been considered an unavoidable defect of indicators, and if this claim can be substantiated, the free piston will be admitted to be an important improvement.

We had expected to be able to present a diagram taken to test this matter. but have been unable to obtain one in time.

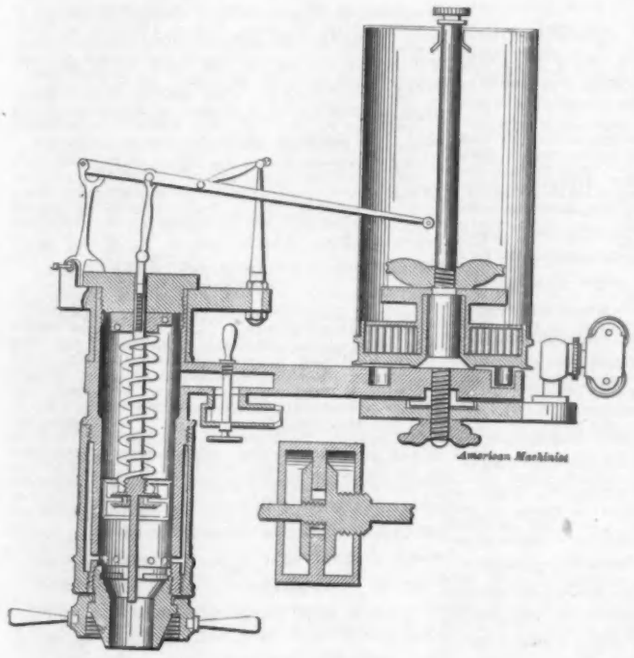


Fig. 1

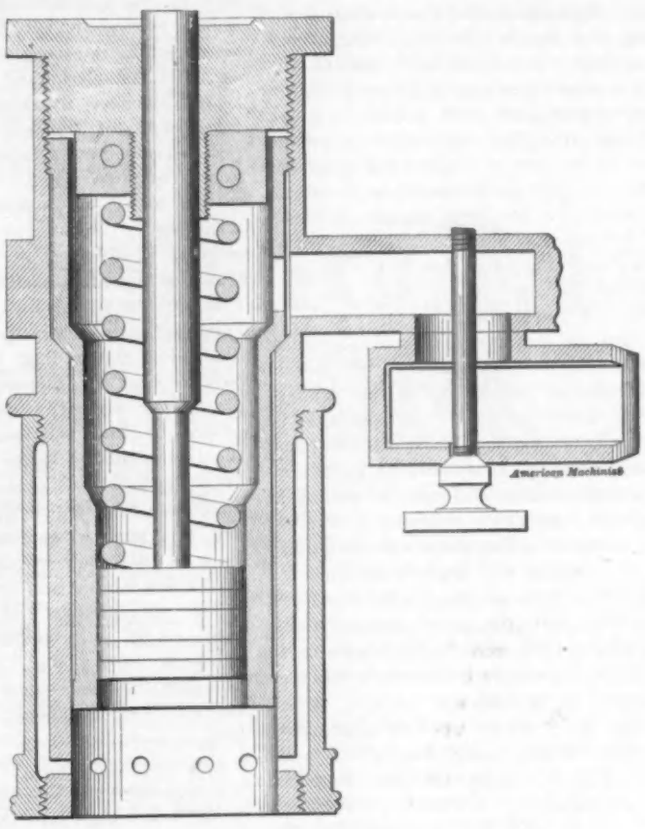


Fig. 2

NEW STEAM ENGINE INDICATOR.

Letters from Practical Men

Foreign Shipments.

Editor American Machinist:

In reply to Mr. Bollinckx's letter on foreign shipping bills, in the "American Machinist" of May 18, it might be interesting to some of your readers to know what others are doing in this line.

On all our foreign shipments we generally number our boxes and pieces consecutively from 1 up. Each piece or box is plainly stamped with the address of the consignee, the number, the gross and net weight and tare; the length, breadth and hight of the piece, and then a private mark or character for quick identification. The shipping bill covers the total number of packages with the entire weight and car number. We then furnish our customer with a detail invoice, giving the box number, dimensions and weights as before noted, also a list of the contents of each individual package.

When he gets this, he knows exactly what is coming, and can then open the box containing the parts that he wishes to use first. In a recent shipment of refrigerating machinery to England we had in the neighborhood of fifty packages, so it can be readily seen what a convenience such an arrangement is. One cannot be too careful in boxing, as the handling these foreign shipments get is extremely rough, and only the stoutest boxes, securely bound with hoop iron, should be used.

WM. C. MCLEOD,
Supt. Buffalo Steam Pump Co.

Wasting Wind is Wasting Windmills.

Editor American Machinist:

I do not believe with your correspondent "Objector," in issue of May 18, that "some day in future ages the windmill will be as great a benefactor to the human race as in the past it was to the lowlands of Holland," so that it may not be proper to waste much time in discussing either its inefficiencies or any other particulars concerning it; but as far as we do go, it is proper to do the thing right. The windmill as now usually made is arranged for one constant resistance or load. Until there is wind enough to overcome that resistance the wheel does not turn, and no work is done. When, as often occurs, there is much more wind than is required to overcome the resistance, all that surplus of wind is rejected and additional work that might be done is not done. Work is lost or wasted at both ends, and, what is the real grievance, the windmill also is wasted. The same mill might do double the work, or a mill of one-half the capacity might be made to do the work that

it does. It is this waste of windmills that I am talking about, and I am not the one who is talking nonsense about merely wasting wind. That thousands of windmills are doing all that is required of them, and that thousands of persons are satisfied with windmills as they are, need not compel us to shut our eyes to the actual inefficiency of the machine, even if we can only point out this inefficiency and cannot also specify in detail the means by which it is to be eliminated. Some investigators have pointed out the inefficiencies of the steam engine, and thereby have shown other experimenters and designers the opportunities which they have availed themselves of. The finding of the faults and the deficiencies in steam engines and other mechanical devices has been a very important aid toward their improvement, and must always continue to be so. We have seen a great improvement in machine tools, and a greater advance in their performance and output, but none of it has been brought about by the fellows who have been quite satisfied with everything as it was, and who have been on the alert to cry down the suggesters of better things.

I suppose that people are usually quite in the habit of overestimating the power of windmills, and it may in this connection be quite proper to call attention to some reliable information which has come to my notice. Professor King, of the Wisconsin experiment station, has made a reliable record of a year's work of a 16-foot windmill. The work was the pumping of water 10 feet high to be used for irrigation. One of the standard wheels was used with the usual arrangements, and no attempts seem to have been made to secure any results better than ordinary. The total volume of water raised 10 feet in 365 days was 3,449,939 cubic feet. The average running of the windmill for the whole year was 14.32 hours per day. For the period from March to September, when its services were most needed, the average day's work was 10.74 hours. For one entire week it had not enough wind to work. The work of the windmill for the year was compared with that of a 2½ horse-power gas engine, running 10 hours per day at a daily cost of 95.4 cents. It was found that the engine would pump 2.35 times as much water as the windmill. The windmill, therefore, measured by the engine cost, did $95.4 \div 2.35 = 40$ cents' worth of work per day. This would be, say, $145 a year, or 10 per cent. of $1,450, the 10 per cent. covering investment, repairs and depreciation. If for a few dollars the wheel could be made to do considerably more, and if the additional work could be all made available, as in irrigation service it would be, then it would be a wise investment; but if the additional dollars were put on to the first cost of the wheel the builder might shut up his shop because he couldn't sell his wheels. That is how the thing would work, and it works the same way with many other things besides windmills. The machine shop proprietor despises the penuriousness of the farmer, and then often unconsciously imitates him.

. . . . . .

Sometimes we are apt to think that we have nearly exhausted the possibilities of economy in certain directions. In the matter of power development we don't see very far ahead as to the means of improvement. With the steam engine especially, although we keep on tinkering with it, and keep gaining little by little on the coal pile, we have settled it all around that we can't possibly go much further. When our minds get finally and firmly fixed on this it is a good time to go out, as I did last week, and buy a mackerel. A salt mackerel won't do. It must be a fresh one, and you will be lucky if you get as big a one as I did. The mackerel that I bought weighed, just as it came out of the water, 42 ounces. It had a roe weighing 5 ounces, and, as that has nothing to do with our case, we deduct that, leaving the talkable weight of the fish 37 ounces. I had the fish boiled; and that's the correct way to cook it. And after the boiling, the digestive apparatus and the material in process of conversion having been previously removed, the head and tail, the fins, and all the bones, and the skin were also taken away, leaving nothing but what was eatable, and all of which was actually eaten, and this portion weighed 24 ounces, or 24-37 or 64.8 per cent. of the total weight of the fish.

This portion that was left, nearly two-thirds of the total weight of the fish, was of course pure muscle. It was the executive portion of the machine. Comparing the fish with a locomotive, for instance, here were the steam cylinders and pistons, the connecting rods and the cranks, weighing two-thirds of the machine, while the boiler and fuel and tender and frame and valve motion and all the rest of it weighed only one-third of the whole. I would have liked to have weighed the fuel and the water consumed by the fish, and then to have taken indicator cards or dynamometer diagrams from it on its trip across the Atlantic, and from these to have deduced its efficiency, but I was prevented from doing so; but I have no doubt that the record would have been one that the fish would have found no occasion to be ashamed of. Certainly if the relative weights of boiler and of engine are any indications of the efficiencies, we are far enough from the possibilities in power development. The relative sizes of boiler and of steam cylinder will have to be reversed. It seems certain, indeed, in the presence of the fish, that the boiler will yet have to be thrown away, and the discussion of water tubes and fire tubes, of forced draft and natural draft, of high pressures and low pressures we may yet live to laugh at. This is a much bigger topic than that of the windmill.

TECUMSEH SWIFT.

Photographed Reference Drawings.

Editor American Machinist:

I noticed in issue of May 18, page 30, reference to our small drawings. This little reference does not fully indicate the purpose of these drawings. We send you prints I-65 and I-66, which you will see are not 8x10 inches, but are on standard size sheets (6x9 inches), photographed down from larger size drawings by a 5x8-inch camera. The purposes of getting our prints into this shape are manifold—one to furnish our authorized agents with pretty complete drawings of our machines, without considerable expense; also to furnish the superintendent of the shop with sets of drawings which he can have at his desk and look over conveniently. In fact, the number of advantages which this print will open up will steadily increase. You will observe that by the use of a glass every dimension on these prints is readily readable. This makes it especially desirable for mailing purposes, especially on foreign inquiries where large prints are expensive to mail, while the expense of making this photo reduction is only 15 cents a plate, which can be made up in the expense of two or three of the regular blueprints.

F. H. S.,
The Watson-Stillman Co.

Cast Iron Dies.

Editor American Machinist:

I was very much interested in an article on "Cast Iron Dies" in the "American Machinist" of May 11, by Mr. R. I. Clegg, and I want to add my mite on the same subject, for heavier work. We have made many dies of cast iron for bending and forging wrought iron and steel, and where the corners are not required to be too sharp have had very good results. We cast the dies for drop hammer or press with the tongues solid, so that all is in one piece. The part I wish to call particular attention to, however, is that we are using a very hard iron for grinder burrs and work of that kind, and when we want a die to last we cast it in the hard metal, but to do so we must have the pattern correct to size and smooth, as no filing can be done on this hard iron. These dies last to do an immense amount of hard forging and bending.

We have one bending form for a steel crank of 1-inch round steel with sixteen bends. The form is part cast and part steel. The steel corners always give out first. The hard metal lasts much longer and gives better results, as the hot steel does not soften it; but the steel pieces on the form soon get so soft that they bruise easily and get out of shape, so they have to be renewed often.

EZRA ESTEP.

Sandwich, Ill.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Boiler-maker's punch and shears wanted, at Dover Boiler Works, Dover, N. J.

The Dutton Wet Twist Drill Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.,R.I. Send for index sheet.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—Repair shop in good town of 5,000; good tools, in rented building, $2,000; terms to suit. Address S. G. Hunter, Atlantic, Iowa.

Second-hand books, cheap; scientific, mechanical, miscellaneous; catalogs free; send postal for one. Industrial Pub. Co., 16 Thomas st., New York.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

Building to rent, 176x75 ft., R. R. siding, with or without power, only 17 miles from New York city, on Central R. R. of N. J. Box 13, AMERICAN MACHINIST.

The Waltham Machine Works, Waltham, Mass., make a specialty of accurate work. Correspondence in regard to small automatic machinery, punches and dies, etc., is solicited.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Young mechanical draftsman, with 5 years' shop experience, desires change. Box 25, AMERICAN MACHINIST.

Wanted—Situation; competent mechanical draftsman; detail work preferred; references. Box 350, AMERICAN MACHINIST.

An A1 blacksmith desires a position as foreman; age 30; 12 years' experience. Address Box 24, AMERICAN MACHINIST.

A good machine blacksmith desires a change; either light or heavy work. Address Box 23, AMERICAN MACHINIST.

Draftsman wants change; four years' experience on cotton machinery; references furnished. Box 18, AMERICAN MACHINIST.

Designer of machine tools, with 14 years' experience (shop and drawing), open for position. Box 26, AMERICAN MACHINIST.

First-class, experienced pattern-maker desires a change; steady position preferred, and located in the East. Box 29, AMER. MACH.

Experienced draftsman wants change; N. Y. city preferred; steam and gas engines and heavy machinery. Box 17, AMER. MACHINIST.

General utility man, practical cost accountant; experience as draftsman and purchasing agent; technical graduate. Box 14, AMERICAN MACHINIST.

Wanted—Position as foreman of machine shop, by a thorough, practical mechanic; one who can handle men. Address Box 22, AMERICAN MACHINIST.

Foreman pattern-maker, 36, desires to change; experienced on marine engine and machine work; good draftsman. Box 20, AMERICAN MACHINIST.

Machinist and technical graduate desires position in machine shop or with manufacturing company; chance for promotion. Box 348, AMERICAN MACHINIST.

A man with experience as designer, manager and selling agent, machine tools and textile machinery, wants position; satisfactory references as to all points. Address Box 19, AMERICAN MACHINIST.

Situation, by a thorough mechanic with shop drawing-room and traveling experience in machine tools; can add new line of profitable machines with right parties. Address Box 12, AMERICAN MACHINIST.

As superintendent of manufacturing plant; good executive ability and successful manager of men; can introduce systematic and economical methods; presses, dies and sheet-metal working machinery a specialty. Address Box 21, AMERICAN MACHINIST.

Young man of thorough experience in the application of up-to-date methods, able to design and produce cost-reducing tools, jigs, etc., at present holding responsible position, open for position as foreman or assistant superintendent. Box 27, AMER. MACHINIST.

Mechanical engineer and draftsman, 7 years' shop experience and 9 years' drawing-room experience; well posted on hydraulic and heavy power-transmitting machinery; permanent position desired; first-class reference furnished. Address Box 30, AM. MACH.

Help Wanted.

Wanted—A No. 1 draftsman and designer; one who has had experience on electric traveling crane work. Address Box 16, A. MACH.

Several first-class tool makers wanted on light interchangeable work; state age, experience and wages expected. Box 28, AMERICAN MACHINIST.

Wanted—Mechanical draftsman, familiar with Corliss engine work; state training, experience, age and salary expected; also give references. The Bass Foundry & Machine Co., Fort Wayne, Ind.

Working foreman wanted for a small machine shop in a Connecticut city; must be acquainted with small engine work and an all-round man of good habits. Address Box 15, AMERICAN MACHINIST.

Wanted—Competent man for superintendent of factory employing 350 men and boys; must be thorough mechanic and understand fully screw machines and screw-machine products. Address, giving experience and salary expected, "Screws," care AMER. MACH.

Wanted—Foreman, by an old, reliable firm in the steam fittings and brass goods line in the center of Germany, for brass foundry employing about 70 men; knowledge of German language required; state experience, age and wages expected. Box 335, AMER. MACHINIST.

Draftsman Wanted—A steady position is open to a draftsman capable of designing machinery under advice; must have some acquaintance with modern shop methods; applicants will please give full particulars, such as age, salary required, experience, etc. Box 10, AMERICAN MACHINIST.

Wanted—Draftsman with thorough machine-tool building experience, thoroughly familiar with shop drawings and designing of metal-working machines; state experience, wages expected, references, etc. A permanent position in New England for the proper man. Box 11, AMERICAN MACHINIST.

Wanted—A thoroughly practical and experienced draftsman and tool-maker who is capable of designing and making tools and jigs to turn out a piece of mechanism on the lines of a watch made of brass in the most modern and economical way; state age, experience and salary demanded. Box 333, AMERICAN MACHINIST.

The Delaware, Lackawanna & Western Railway nas issued an order forbidding its employees to engage in outside business. It is aimed at a number of the foremen who are interested in general stores and have been exerting their influence to make the men under them patronize these stores.

A New Induction Coil.

An induction coil of great power has been invented by Mr. T. B. Kinraid, of the Spring Park Laboratory, Jamaica Plain, Mass. The coil, which is described as unique in its form, was described by the inventor at a recent meeting of the Society of Arts of the Massachusetts Institute of Technology. By the aid of the coil some interesting studies have been made of the differences in the character of electric discharges from the positive and negative poles. Photographic plates were balanced on the point of discharge, and, after operating the coil in a dark room, the plates were developed. At the lecture the apparatus was shown in operation, and the developed plates were shown by means of the lantern. The figures are described as being of extraordinary size, beauty, and delicacy of detail. It is thought that designers and decorators may obtain useful suggestions from them.

Personal.

Mr. J. S. Taylor, of the firm of Taylor & Challen, engineers, of Birmingham, England, is visiting here for about six weeks.

The American Academy of Arts and Sciences has awarded to Charles F. Brush, of Cleveland, the Rumford Medals "for practical development of arc lighting."

The Royal Institution of Great Britain, in commemoration of its centenary, has elected as honorary member, among others, Prof. R. H. Thurston, director of Sibley College, Cornell University.

Messrs. H. S. Mosher and J. I. Copeland, of Chicago, recently sailed for Europe, where they expect to stay about three months with the purpose of conducting some practical exhibitions of pneumatic riveting at some of the large shipbuilding yards in England and Scotland. These exhibitions will be carried on in the interests of the Chicago Pneumatic Tool Company, Chicago.

At 5:45 P. M., the 26th ult., a Winton automobile arrived in front of the Astor House in this city, having traveled from Cleveland, Ohio (where it was built by the Winton Motor Carriage Company), in 40 hours 4 minutes running time, and 105 hours 45 minutes elapsed time. The Winton carriage is of the heavier class of gasoline-propelled vehicles and uses only one cylinder. The expense of the trip of 707 miles for fuel is given as "less than a dollar." Some of the roads traversed between Buffalo and Albany are described as fit to disgrace central Africa, and at one point of the journey an accident resulted in a broken forward axle, so that another one had to be sent by express from the factory.

We Make Boring Machines, Milling Machines, Special Tools, BEAMAN & SMITH, Providence, R. I.

Fraudulent Use of a Letter.

Prof. R. C. Carpenter, of Sibley College, Cornell University, writes us that a letter of his being used by the National Fuel Compound Company, of Boston, as an apparent endorsement of "Kalor" is fraudulently so used. Prof. Carpenter says that so far as he knows he never tested "Kalor." He did test a compound known to him as "S. C. (394) Compound" and found it worthless as a fuel or as an improver of fuel.

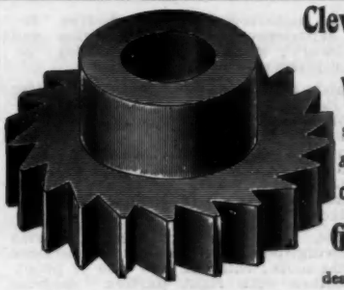
The Birmingham (England) "Daily Mail" publishes an account of an electrical gun which has been invented by a young man who is at present an apprentice in Whitehead's torpedo works. The shot is propelled from a tube by direct application of electric power, and the results obtained by tests of a small gun are described as remarkable; so much so that the Admiralty has offered the inventor $375,000 for his invention, which has been declined.

Mr. R. C. McKinney, of the Niles company, informs us that the published report to the effect that the Niles Tool Works and Bement, Miles & Co. have become affiliated has no foundation in fact. It seems to be simply a revival of something that was talked of about three years ago, but that has not been considered recently.

The Baldwin Locomotive Works continue to take orders for locomotives to be run on British railways, and have recently taken an order for one to be used in the development of that part of Palestine selected for the Zionist movement.

In our description of Prof. Rogers' precision lathe last week, we printed his name as W. S. Rogers. It should have been W. A. Rogers.

The Institute for Home Study of Engineering, of Cleveland, has been incorporated with the United Correspondence Schools, of 156 Fifth avenue, New York.



Cleveland Gear Works
W. R. SAWYER, Lessee.
86 Seneca St., Cleveland, Ohio.
GEARS of all descriptions.

Wanted---Bicycle Factory.
Want to buy a fully equipped factory, must have up-to-date machinery in good working order. Will use for other purposes. Correspondence confidential.
MOFFETT BEARING COMPANY,
1501 Fisher Bldg., CHICAGO.

Bullock Quality
in Electric Motors and Generators is the best obtainable.
We have made it so by care, good judgment and good engineering. With our new works, the most modern of their kind in the world, we propose to maintain this record.
Bullock Electric Mfg. Co.,
Cincinnati, O., U. S. A.
I 5-25-99

The CROSS OIL FILTER

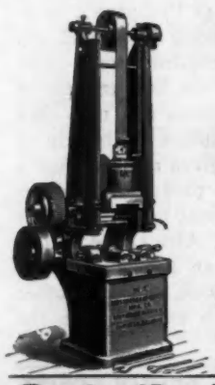
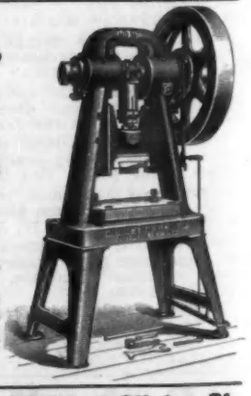
actually reduces oil bills 50% or more. Sent on approval. Capacities 3 to 150 gals. per day. Used in 23 countries. Testimonials from the leading firms in every field of industry.
THE BURT MFG. CO.
AKRON, OHIO, U.S.A.
Business Established 9 Years.
Largest Manufacturers of Oil Filters in the World.

TAKE THEM OFF.
You are not compelled to wear overalls all your life. You can obtain an education which will qualify you for a better position and higher pay if you will devote some of your spare time at home to study at a cost so low that you will not feel the outlay. Courses by mail in
Mechanical, Steam and Electrical Engineering,
Mechanical Drawing and Machine Design.
Best Text Books and Drawing Plates Free.
Seven years of experience in teaching by correspondence. Write for our illustrated Circular T, sample pages of text books, drawing plate and booklet of letters from students all over the world.
The United Correspondence Schools,
154, 156, 158 Fifth Ave., New York.

Arthur's Grip Hoists
Will Convert Your Hand Elevators into Power Ones at Small Cost.
THE ARTHUR CO., 186 FRONT STREET, NEW YORK.
ASK FOR HOIST CATALOG.

GEARS Cut and manufactured quickly and accurately by
THE ARTHUR CO., 186 Front St., N. Y.

CUTTING OFF MACHINES, THE LATEST AND BEST.
HURLBUT ROGERS MACHINE CO.
SO. SUDBURY, MASS.
German Agents: Schuchardt & Schutte, Berlin and Vienna.
English Agents: Chas. Churchill & Co., Ltd. London and Birmingham.


MOSSBERG & GRANVILLE MFG. CO. PROVIDENCE, R. I.
Manufacturers of
ROLLING MILLS WITH ROLLER BEARINGS **DROP PRESSES**
POWER PRESSES, WIRE DRAWING MACHINERY
If in the market for the above machinery, write stating product required and send samples and we will send you photographs of our latest productions.
NEW YORK OFFICE, 126 LIBERTY ST. EXHIBITION AT PHILADELPHIA BOURSE
FOREIGN AGENTS:—Charles Churchill & Co., Ltd., London and Birmingham, England. A. Mathey-Doret, La Chaux-de-Fonds, Switzerland. De Fries & Co., Dusseldorf and Berlin, and Vienna, Austria. Adolphe Janssens, Paris, France.


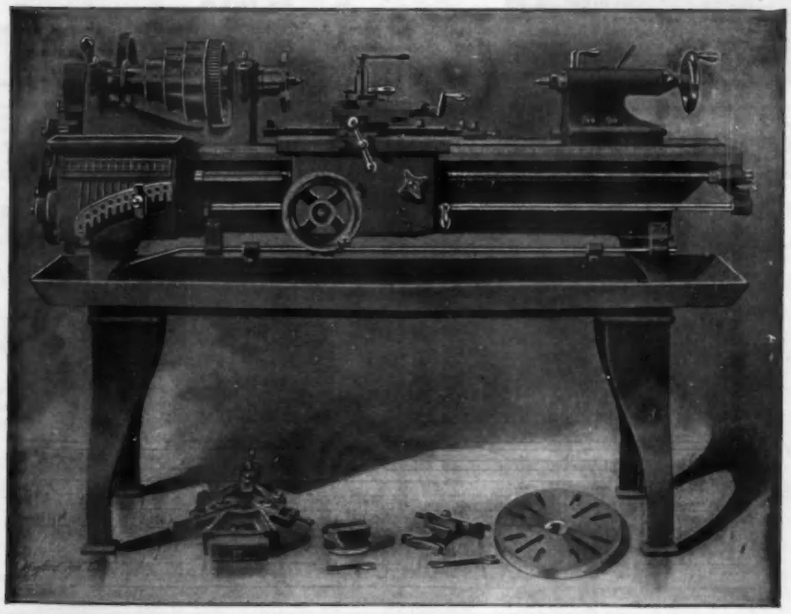
Quint's Turret Drills, For Drilling and Tapping, are made with from Four to Twelve Spindles. A. D. QUINT, 3 Clinton St., Hartford, Conn.

The Hendey Machine Co.

TORRINGTON, CONN.

This Company is the sole owner of Letters Patents Nos. 468,183, 470,591, 519,294, 549,006 and 557,031, granted to P. & W. Schellenbach, W. P. Norton, and W. L. Schellenbach, for Improvements in Engine Lathes.

We take this method of notifying the public that we have already commenced suit against infringers of these patents, and that should it be found necessary to the protection of our rights, additional suits will be brought against manufacturers, vendors and users of infringing lathes.



The merits of these improvements have been widely recognized and have been wantonly copied. We shall take vigorous steps to protect our own.

The Hendey Machine Co.,

TORRINGTON, CONN.

UNITED STATES AGENTS:

Hill, Clarke & Co., Boston. Manning, Maxwell & Moore and The Garvin Machine Co., New York. J. W. Cregar, Philadelphia. U. Baird Machinery Co., Pittsburgh. The E. A. Kinsey Co., Cincinnati. Manning, Maxwell & Moore, Chicago. Pacific Tool & Supply Co., San Francisco.

EUROPEAN AGENTS:

Schuchardt & Schütte, Berlin, Vienna, Brussels, Stockholm. Chas. Churchill & Co., London and Birmingham, England. Adolphe Janssens, Paris, France.

The closing lecture in the course of special railway lectures at Purdue University was delivered on May 2 by the Hon. D. P. Baldwin, of Logansport, Ind. Judge Baldwin, who is a close student of economics, took for his subject "Railway Prejudices," treating the subject from the standpoint of the general public. He gave the history and causes for the prejudices which very generally exist in the public mind against railways, showing that these prejudices were in the beginning well founded, but that in later years conditions had materially changed, and that methods of railway management and operation were no longer subject to the abuses which held in former years.

During the months of June and July a series of courses of study will be given at the Massachusetts Institute of Technology, Boston, which courses are open to persons not already students at the institute if they possess the necessary qualifications. Among the subjects to be covered, those which are of particular interest to mechanics are as follows: Mechanical drawing and descriptive geometry; mathematics; physics; practical work in wood working, forge, and machine shops and mechanism. Those likely to attend are advised to correspond as early as possible with the secretary of the institute for particulars as to plans of study, opening of the courses, etc.

Manufacturers.

At Attleboro, Mass., Bates & Bacon are to erect a new factory.

Joseph Bird will build a four-story factory building at 121 Market street, Philadelphia.

S. O. Bigney & Co., contemplate the erection of a new factory building at Attleboro, Mass.

The works of the Dighton Stove Lining Company at South Dighton, Mass., were completely destroyed by fire recently, with a loss estimated at $20,000.

The name of the Powell Planer Company, Worcester, Mass., has been changed to the Woodward & Powell Planer Company. The corporation will remain under the same management.

J. P. Mathieu & Co. are to erect a factory building at Ninth and Tenth streets, Philadelphia, Pa. Complete power plant will be installed, including electrical, steam-heating and ventilating machinery, boilers, engines, etc.

The old radiator company of Uniontown, Pa., has been reorganized, and will be capitalized at $25,000. The new officers are: President, Fuller Hogsett; Vice-President, A. L. Moser; Secretary, L. G. McCrum; Treasurer, I. W. Semans.

By an arrangement recently made, the Chicago Pneumatic Tool Company has arranged with the National Pneumatic Tool Company to sell the entire output of their factory, in connection with the line of pneumatic tools now handled by the Chicago company.

The Landis Tool Company, Waynesboro, Pa., has recently placed an order with the Shiffler Bridge Company, Pittsburgh, for structural material for increasing their machine shop to twice its present size. The addition will be an 80-foot by 80-foot two-story building.

It is estimated that the loss caused by the recent fire that partially destroyed the tierce and barrel cooperage works of John Eizner, Chicago, will reach $50,000. The wood-working machinery, estimated to be worth $35,000, which was placed in the factory a year ago, was totally destroyed.

The box factory and wood-working establishment of F. P. Bartlett & Co., Westboro, Mass., was partially burned recently, the interior of the building being cleared out and the machinery probably ruined. The losses are thought to be about $4,000 on the building, $3,000 on machinery and $1,200 on stock on hand.

The machine shop and foundry business of Osgood & Barker, Bellows Falls, Vt., was recently purchased by a concern known as the Bellows Falls Machine Company. The new owners are to enlarge the business. The shop has been engaged in the manufacture of paper and pulp machinery and general machine and foundry work.

It is claimed to be practically settled that the new plant of the New York Shipbuilding Company will be at Camden, N. J. A site is understood to have been selected and the municipal government asked to fix the valuation of the land for assessment for twenty years. The company proposes to buy 100 acres of land.

The Downey Manufacturing Company, Menominee, Mich., was organized recently with a capital of $25,000. The incorporators are A. B. Stryker, A. W. Blom, P. Libenaler, Capt. J. M. Dalton, Louis Campbell, R. H. Downey. A factory will be built for the manufacture of new inventions covering sawmill, bicycle and sewing machinery.

The Ellisville (Miss.) Cotton Mill Company has been organized with a capital stock of $500,000. The incorporators are S. J. Johnson, I. Anderson, J. P. Myer, N. B. Shelby, B. F. Fridge and W. S. Pettis, of Ellisville; E. H. Roberts, of Baltimore, and C. L. Wortham, of Memphis, Tenn. Work on the erection of the buildings will start at an early date. All of the capital stock has been subscribed for.

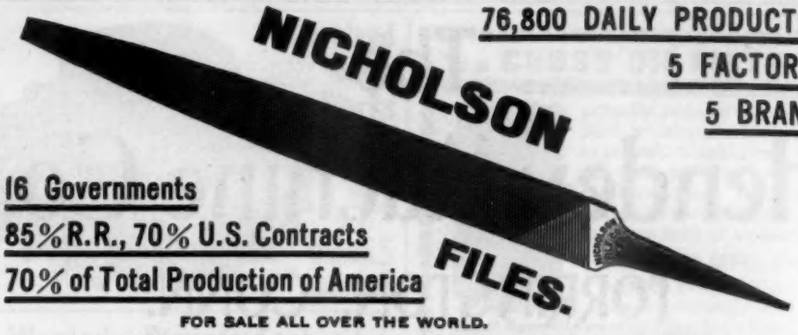
Black & Gloninger closed another deal recently, selling for the Glassport Land Company, of Glassport, Pa., to S. Severence, of Pittsburgh, Pa., a tract of four acres at Glassport. The purchaser will immediately begin to erect a manufacturing plant to manufacture spikes and rivets. When completed, the plant will give employment to 150 men. The main building will be 80x300 feet. A number of smaller buildings will be put up, and the plant will begin operations in the fall.

The Rome Brass & Copper Company, Rome, N. Y., have placed an order for the steel buildings for a brass plant with the Berlin Iron Bridge Company, of East Berlin, Conn. The contract comprises a boiler house and an engine house, 40 feet wide and 120 feet long, a casting shop 50 feet wide and 90 feet long, and a tube mill 120 feet wide and 200 feet long. The framework of all these buildings is steel. The roofs have a flat pitch covered with tar and gravel, and the sides are arranged with a quantity of glass supported on steel framework. The building is modern in arrangement and construction.

New Catalogs.

We have received from the American Watch Tool Company, Waltham, Mass., catalog of precision machinery, including bench lathes, bench milling machines, bench tapping machines, profiling machines, and other similar devices used in the manufacture of watches, etc. The catalog is standard size, 6x9 inches.

76,800 DAILY PRODUCTION
5 FACTORIES
5 BRANDS

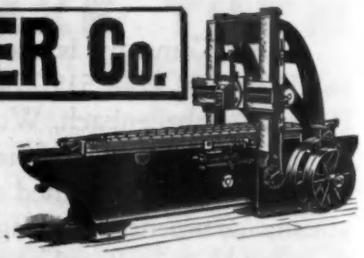


16 Governments
85% R.R., 70% U.S. Contracts
70% of Total Production of America

FOR SALE ALL OVER THE WORLD.
NICHOLSON FILE CO., Providence, R. I., U. S. A.

POWELL PLANER Co.

WORCESTER, MASS.



U. Baird Machinery Co., 125 Water St., Pittsburgh, Pa.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy Co., 502 North 2d St., St. Louis, Mo.
Parke & Lacy Co., Fremont St., San Francisco, Cal.
The Fairbanks Co., 705 Arch St., Philadelphia, Pa.

COMPARE WEIGHTS

WHEN YOU ARE TOLD THAT JENKINS' '96 IS MORE EXPENSIVE THAN OTHER PACKINGS.

Average weight ⅛ inch "Jenkins '96," 11 lbs. to the square yard.
" " " ⅛ " Red Packing, 14 " " " "

At 50c. per pound "JENKINS' 96" is not only very much cheaper, but the best joint packing manufactured.

JENKINS BROS. NEW YORK, BOSTON, PHILADELPHIA, CHICAGO.

Press-Working of Metals—A treatise upon the principles and practice of Shaping Metals in Dies by the action of presses, together with a description of the construction of such implements in their various forms, and of the materials worked in them. By OBERLIN SMITH.

Illustrated with 433 Engravings. 276 pages. 8 vo. Cloth.....$3.00

JOHN WILEY & SONS, 53 East Tenth Street, NEW YORK CITY.

GRINDING UP MONEY

In using soft abrasives you are grinding up money that you might save.

CARBORUNDUM

is the best abrasive because it is the hardest substance known excepting the diamond.

It is made up in many forms, embracing crude crystals, grains and powders, wheels, sticks, knife sharpeners, hones and bricks, paper and cloth, and dental goods.

THE CARBORUNDUM CO., NIAGARA FALLS, N.Y.

TOOLS A Large Assortment of Regular and Special Tools for Machinists.

If you want "The Best That's Made," write us.

HAMMACHER, SCHLEMMER & CO., 209 BOWERY, NEW YORK.

If it's anything in the Tap or Die line, you can get it of Card, and be sure it's right. Brown Book shows all sorts.

S. W. CARD MFG. CO., Mansfield, Mass., U. S. A.